P-2802H(W)(L)-I Series

VDSL VoIP IAD

User's Guide

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Edition 1

ZyXEL

www.zyxel.com

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the ZyXEL Device using the web configurator. You should have at least a basic knowledge of TCP/IP networking concepts and topology.

Related Documentation

- Quick Start Guide
  The Quick Start Guide is designed to help you get up and running right away. It contains information on setting up your network and configuring for Internet access.
- Web Configurator Online Help
  Embedded web help for descriptions of individual screens and supplementary information.
- Supporting Disk
  Refer to the included CD for support documents.
- ZyXEL Web Site
  Please refer to www.zyxel.com for additional support documentation and product certifications.

User Guide Feedback

Help us help you. Send all User Guide-related comments, questions or suggestions for improvement to the following address, or use e-mail instead. Thank you!

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Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.

Warnings tell you about things that could harm you or your device.

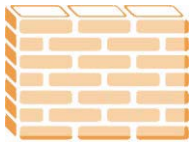
Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The P-2802H(W)(L)-I may be referred to as the "ZyXEL Device", the "device", the "system" or the "product" in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the "enter" or "return" key on your keyboard.
- "Enter" means for you to type one or more characters and then press the [ENTER] key. "Select" or "choose" means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the "metric" value or the "scientific" value. For example, "k" for kilo may denote "1000" or "1024", "M" for mega may denote "1000000" or "1048576" and so on.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The ZyXEL Device icon is not an exact representation of your device.

ZyXEL Device	Computer	Notebook computer
Server	DSLAM	Firewall 
Telephone	Switch	Router

Safety Warnings

For your safety, be sure to read and follow all warning notices and instructions.

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Use ONLY an appropriate power adaptor or cord for your device.
- Connect the power adaptor or cord to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- Do NOT allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the device and the power source.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightning.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.
- Use only No. 26 AWG (American Wire Gauge) or larger telecommunication line cord.
- Antenna Warning! This device meets ETSI and FCC certification requirements when using the included antenna(s). Only use the included antenna(s).

This product is recyclable. Dispose of it properly.

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PART I
Introduction

Introducing the ZyXEL Device (35)
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1

Introducing the ZyXEL Device

This chapter introduces the main applications and features of the ZyXEL Device. It also introduces the ways you can manage the ZyXEL Device.

1.1 Overview

The P-2802HW(L) series are Integrated Access Devices (IADs) that combine a VDSL2 router with Voice over IP (VoIP) communication capabilities to allow you to use a traditional analog telephone to make Internet calls.

VDSL2 is the second generation of the VDSL (Very High Speed Digital Subscriber Line) (which is currently denoted VDSL1) standard. The following table shows you the main differences between VDSL1 and VDSL2.

Table 1 VDSL Standards

FEATURE / STANDARD	MAX. BANDWIDTH	MAX. DATA RATE	SPECTRUM COMPATIBILITY WITH ADSL/ADSL2/ADSL2+
VDSL1	12 MHz	Upstream: 12 Mbit/s Downstream: 52 Mbit/s (at about 300 meters (1000 ft))	No
VDSL2	30 MHz	Upstream: 100 Mbit/s Downstream: 100 Mbit/s (using a bandwidth up to 30 MHz at 0.5 km (1640 ft) (over short cable lengths))	Yes

The P-2802HW(L) is the ideal secure wireless firewall router for all data passing between the Internet and LAN. You can configure firewall and/or content filtering for secure Internet access. You can also use QoS to efficiently manage traffic on your network.

At the time of writing, this guide covers the following models.

Table 2 Models Covered

P-2802HWL-I1	P-2802HW-I1	P-2802H-I1
P-2802HWL-I3	P-2802HW-I3	P-2802H-I3

Not all models include all features. Please refer to the following description of the product name format.

- “H” denotes an integrated 4-port hub (switch). The “H” models also include Virtual Private Network (VPN) capability.

- "W" denotes wireless functionality. There is an embedded mini-PCI module for IEEE 802.11g wireless LAN connectivity. All wireless features documented in this user's guide refer to the "W" models only.
- "L" denotes the PSTN (Public Switched Telephone Network) line feature. The PSTN line lets you have VoIP phone service and PSTN phone service at the same time. All PSTN line features documented in this user's guide refer to the "L" models only.

When the ZyXEL Device does not have power, the phone(s) connected to the **PHONE** port(s) can still be used for making PSTN calls. Only one phone can be in use at a time.

- Models ending in "1", for example P-2802HWL-I3, denote a device that works over the analog telephone system, POTS (Plain Old Telephone Service). Models ending in "3" denote a device that works over ISDN (Integrated Services Digital Network).

Only use firmware for your ZyXEL Device's specific model. Refer to the label on the bottom of your ZyXEL Device.

All screens displayed in this user's guide are from the P-2802HWL-I1 model.

See the appendix on Product Specifications for a full list of features.

1.2 Ways to Manage the ZyXEL Device

Use any of the following methods to manage the ZyXEL Device.

- Web Configurator. This is recommended for everyday management of the ZyXEL Device using a (supported) web browser.
- Command Line Interface. Line commands are mostly used for troubleshooting by service engineers.
- FTP for firmware upgrades and configuration backup/restore.
- SNMP. The device can be monitored by an SNMP manager. See the SNMP chapter in this User's Guide.
- SPTGEN. SPTGEN is a text configuration file that allows you to configure the device by uploading an SPTGEN file. This is especially convenient if you need to configure many devices of the same type.
- TR-069. This is an auto-configuration server used to remotely configure your device.

1.3 Good Habits for Managing the ZyXEL Device

Do the following things regularly to make the ZyXEL Device more secure and to manage the ZyXEL Device more effectively.

- Change the password. Use a password that's not easy to guess and that consists of different types of characters, such as numbers and letters.
- Write down the password and put it in a safe place.
- Back up the configuration (and make sure you know how to restore it). Restoring an earlier working configuration may be useful if the device becomes unstable or even crashes. If you forget your password, you will have to reset the ZyXEL Device to its factory default settings. If you backed up an earlier configuration file, you would not have to totally re-configure the ZyXEL Device. You could simply restore your last configuration.

1.4 Applications for the ZyXEL Device

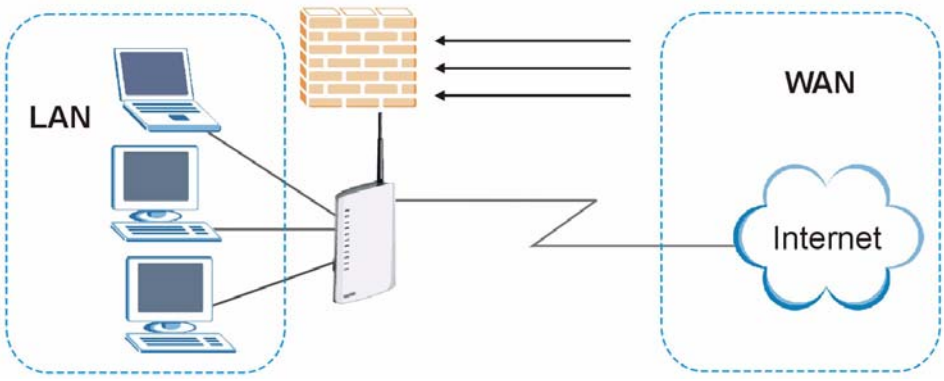
Here are some example uses for which the ZyXEL Device is well suited.

1.4.1 Secure Internet Access

For Internet access, connect the DSL port to the **DSL** or **MODEM** jack on a splitter or your telephone jack for Internet access. Connect computers or servers to the LAN ports for shared Internet access.

The ZyXEL Device guarantees not only high speed Internet access, but secure internal network protection and traffic management as well.

Figure 1 Secure Internet Access Application



You can also configure firewall and content filtering on the ZyXEL Device for secure Internet access. When the firewall is on, all incoming traffic from the Internet to your network is blocked unless it is initiated from your network. This means that probes from the outside to your network are not allowed, but you can safely browse the Internet and download files for example.

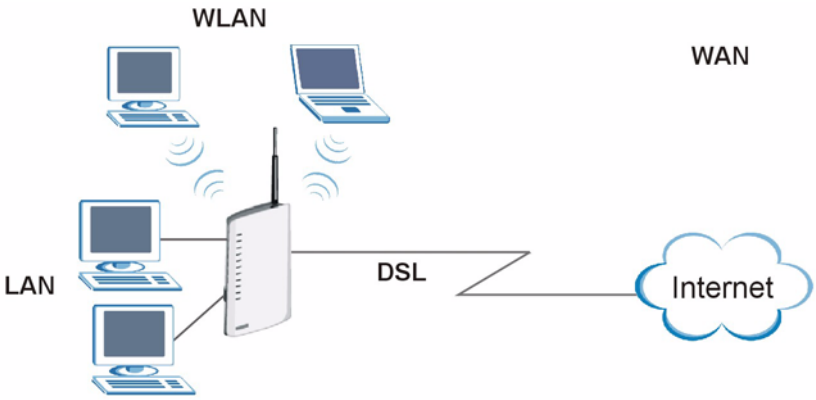
Use content filtering to block access to web sites containing keywords that you specify. You can define time periods and days during which content filtering is enabled and include or exclude particular computers on your network from content filtering. For example, you could block access to certain web sites for the kids.

Use QoS to efficiently manage traffic on your network by giving priority to certain types of traffic and/or to particular computers. For example, you could make sure that voice over Internet calls get enough bandwidth in your network, and/or limit bandwidth devoted to the boss's excessive file downloading.

1.4.2 Wireless LAN Application

Add a wireless LAN to your existing network without expensive network cables. Wireless clients can move freely anywhere in the coverage area and use resources on the wired network.

Figure 2 WLAN Application Example

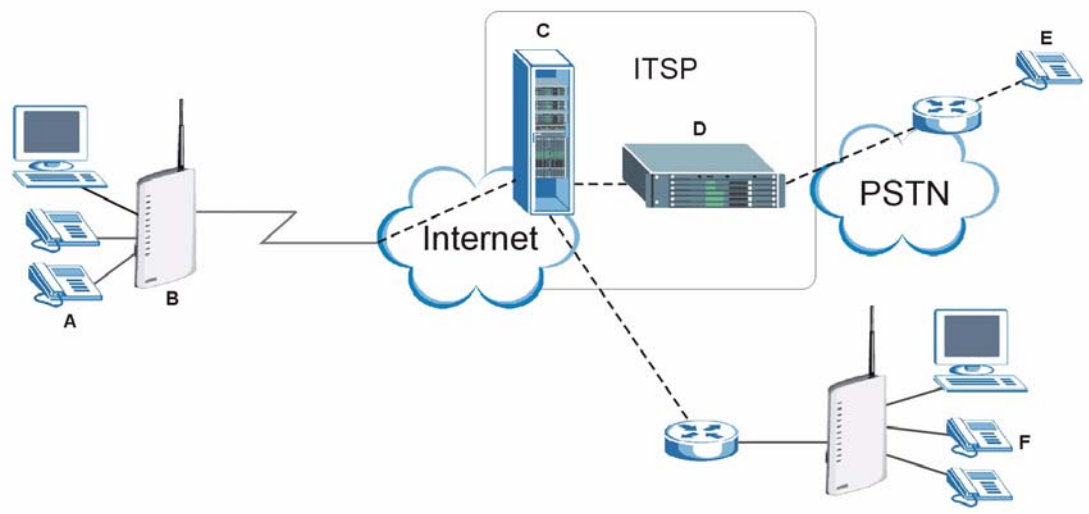


1.4.3 Making Calls via Internet Telephony Service Provider

In a home or small office environment, you can use your device to make and receive VoIP telephone calls through an Internet Telephony Service Provider (ITSP).

The following figure shows a basic example of how you would make a VoIP call through an ITSP. You use your analog phone (**A** in the figure) and your device (**B**) changes the call into VoIP. Your device then sends your call to the Internet and the ITSP's SIP server (**C**). The VoIP call server forwards calls to PSTN phones (**E**) through a trunking gateway (**D**) to the PSTN network. The VoIP call server forwards calls to IP phones (**F**) through the Internet.

Figure 3 Internet Telephony Service Provider Application

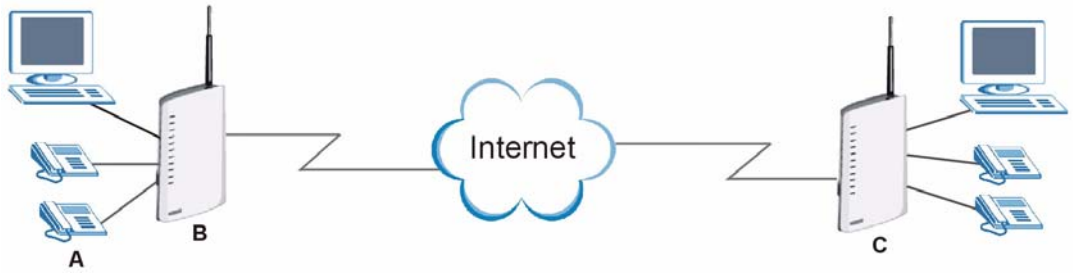


1.4.4 Making Peer-to-peer Calls

You can call directly to someone's IP address without using a SIP proxy server. Peer-to-peer calls are also called "Point to Point" or "IP-to-IP" calls. You must know the peer's IP address in order to do this.

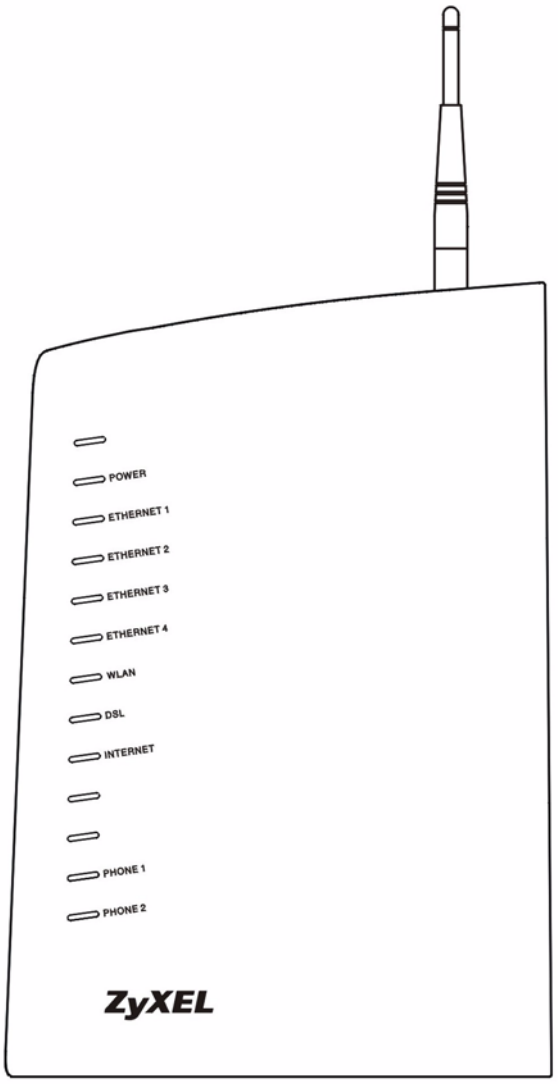
The following figure shows a basic example of how you would make a peer-to-peer VoIP call. You use your analog phone (**A** in the figure) and your device (**B**) changes the call into VoIP and sends the call through the Internet to the peer VoIP device (**C**).

Figure 4 Peer-to-peer Calling



1.5 LEDs

Figure 5 LEDs



The following table describes your device's LEDs.

Table 3 LEDs

LED	COLOR	STATUS	DESCRIPTION
POWER	Green	On	Your device is receiving power and functioning properly.
		Blinking	Your device is rebooting and performing a self-test.
	Red	On	Your device is not ready or there is a malfunction.
	None	Off	Your device is not turned on.
ETHERNET 1-4	Green	On	Your device has a successful Ethernet connection.
		Blinking	The ZyXEL Device is sending/receiving data.
	None	Off	The Ethernet port is not connected.

Table 3 LEDs (continued)

LED	COLOR	STATUS	DESCRIPTION
WLAN	Green	On	Your device is ready, but is not sending/receiving data through the wireless LAN.
		Blinking	Your device is sending/receiving data through the wireless LAN.
	None	Off	The wireless LAN is not ready or has failed.
DSL	Green	On	Your device has a DSL connection.
	None	Off	The DSL link is down.
INTERNET	Green	On	Your device has an IP connection but no traffic. Your device has a WAN IP address (either static or assigned by a DHCP server), PPP negotiation was successfully completed (if used) and the DSL connection is up.
		Blinking	Your device is sending or receiving IP traffic.
	Red	On	Your device attempted to make an IP connection but failed. Possible causes are no response from a DHCP server, no PPPoE response, PPPoE authentication failed).
	None	Off	Your device does not have an IP connection
PHONE 1, 2	Green	On	A SIP account is registered for the phone port.
		Blinking	A telephone connected to the phone port has its receiver off of the hook or there is an incoming call.
	None	Off	The phone port does not have a SIP account registered.

Refer to the Quick Start Guide for information on hardware connections.

1.6 The RESET Button

You can use the **RESET** button at the back of the device to turn the wireless LAN off or on. You can also use it to activate OTIST in order to assign your wireless security settings to wireless clients. If you forget your password or cannot access the web configurator, you will need to use the **RESET** button to reload the factory-default configuration file. This means that you will lose all configurations that you had previously and the password will be reset to "1234". You can also use the

1.6.1 Using The Reset Button

1. Make sure the **POWER** LED is on (not blinking).
2. Do one of the following.

   To turn the wireless LAN off or on, press the **RESET** button for one second and release it. The **WLAN** LED should change from on to off or vice versa. ("W" models only)

   To activate OTIST in order to assign your wireless security settings to wireless clients, press the **RESET** button for three seconds and release it. The **WLAN** LED should flash while the device uses OTIST to send wireless settings to OTIST clients. ("W" models only)

To set the device back to the factory default settings, press the **RESET** button for ten seconds or until the **POWER** LED begins to blink and then release it. When the **POWER** LED begins to blink, the defaults have been restored and the device restarts.

2

Introducing the Web Configurator

This chapter describes how to access and navigate the web configurator.

2.1 Web Configurator Overview

The web configurator is an HTML-based management interface that allows easy device setup and management via Internet browser. Use Internet Explorer 6.0 and later or Netscape Navigator 7.0 and later versions. The recommended screen resolution is 1024 by 768 pixels.

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device. Web pop-up blocking is enabled by default in Windows XP SP (Service Pack) 2.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

See Appendix B on page 349 if you need to make sure these functions are allowed in Internet Explorer.

2.1.1 Accessing the Web Configurator

1. Make sure your ZyXEL Device hardware is properly connected (refer to the Quick Start Guide).
2. Launch your web browser.
3. Type "192.168.1.1" as the URL.
4. A password screen displays. The default password (“1234”) displays in non-readable characters. If you haven’t changed the password yet, you can just click **Login**. Click **Cancel** to revert to the default password in the password field. If you have changed the password, enter your password and click **Login**.

Figure 6 Password Screen

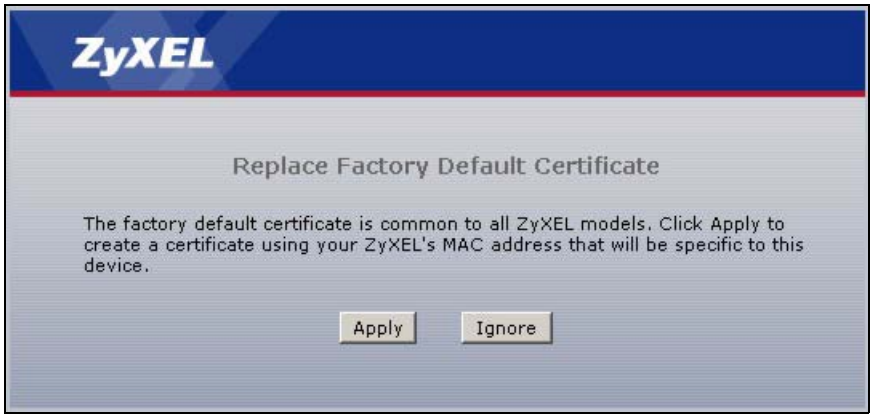
5 The following screen displays if you have not yet changed your password. It is strongly recommended you change the default password. Enter a new password, retype it to confirm and click **Apply**; alternatively click **Ignore** to proceed to the main menu if you do not want to change the password now.

Figure 7 Change Password Screen

ZyXEL
Use this screen to change the password.
Your router is currently using the default password. To protect your network from unauthorized users we suggest you change your password at this time. Please select a new password that will be easy to remember yet difficult for others to guess. We suggest you combine text with numbers to make it more difficult for an intruder to guess.
Enter your new password in the two fields below and click "Apply". Otherwise click "Ignore" to keep the default password
New Password:
Retype to Confirm:
Apply
Ignore

6 Click **Apply** in the **Replace Certificate** screen to create a certificate using your ZyXEL Device's MAC address that will be specific to this device.

Figure 8 Replace Certificate Screen

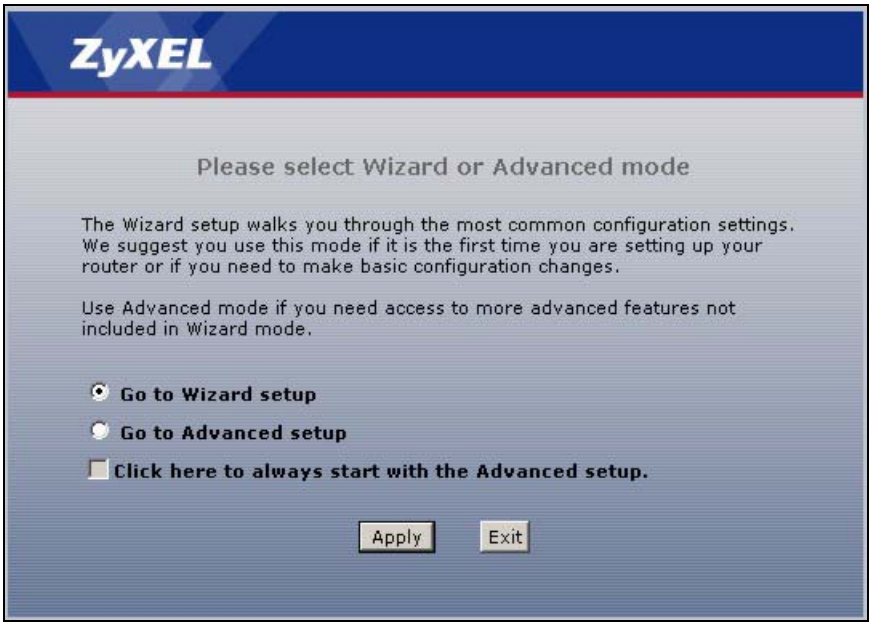

ZyXEL
Replace Factory Default Certificate
The factory default certificate is common to all ZyXEL models. Click Apply to create a certificate using your ZyXEL's MAC address that will be specific to this device.
Apply
Ignore

7 A screen displays to let you choose whether to go to the wizard or the advanced screens.

- Click **Go to Wizard setup** if you are logging in for the first time or if you want to make basic changes. The wizard selection screen appears after you click **Apply**. See Chapter 3 on page 53 for more information.
- Click **Go to Advanced setup** if you want to configure features that are not available in the wizards. Select the check box if you always want to go directly to the advanced screens. The main screen appears after you click **Apply**. See Section 2.2 on page 46 for more information.
- Click **Exit** if you want to log out.

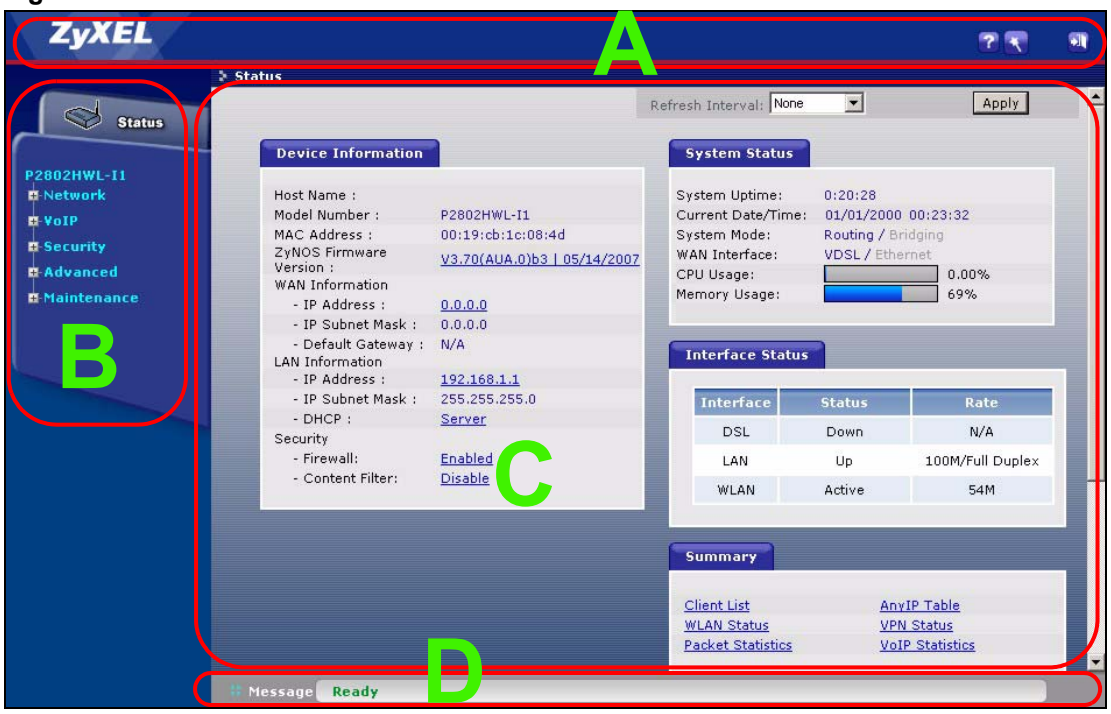
For security reasons, the ZyXEL Device automatically logs you out if you do not use the web configurator for five minutes (default). If this happens, log in again.

Figure 9 Wizard or Advanced Screen


ZyXEL
Please select Wizard or Advanced mode
The Wizard setup walks you through the most common configuration settings. We suggest you use this mode if it is the first time you are setting up your router or if you need to make basic configuration changes.
Use Advanced mode if you need access to more advanced features not included in Wizard mode.
Go to Wizard setup
Go to Advanced setup
Click here to always start with the Advanced setup.
Apply
Exit

2.2 Web Configurator Main Screen

Figure 10 Main Screen



As illustrated above, the main screen is divided into these parts:

- **A** - title bar
- **B** - navigation panel
- **C** - main window
- **D** - status bar

2.2.1 Title Bar

The title bar allows you to change the language and provides some icons in the upper right corner.

The icons provide the following functions.

Table 4 Web Configurator Icons in the Title Bar

ICON	DESCRIPTION
	Help: Click this icon to open up help screens.
	Wizards: Click this icon to go to the configuration wizards. See Chapter 3 on page 53 for more information.
	Logout: Click this icon to log out of the web configurator.

2.2.2 Navigation Panel

Use the menu items on the navigation panel to open screens to configure ZyXEL Device features. The following tables describe each menu item.

Table 5 Navigation Panel Summary

LINK	TAB	FUNCTION
Status		This screen contains administrative and system-related information.
Network		
WAN	Internet Access Setup	Use this screen to configure ISP parameters, WAN IP address assignment, DNS servers and other advanced properties.
	WAN Interface Setup	Use this screen to configure WAN interface settings.
LAN	IP	Use this screen to configure LAN TCP/IP settings, enable Any IP and other advanced properties.
	DHCP Setup	Use this screen to configure LAN DHCP settings.
	Client List	Use this screen to view current DHCP client information and to always assign specific IP addresses to individual MAC addresses (and host names).
	IP Alias	Use this screen to partition your LAN interface into subnets.
Wireless LAN (“W” models only)	General	Use this screen to configure the wireless LAN settings and WLAN authentication/security settings.
	OTIST	Use this screen to assign your wireless security settings to wireless clients.
	MAC Filter	Use this screen to configure the ZyXEL Device to give exclusive access to specific wireless clients or exclude specific wireless clients from accessing the ZyXEL Device.
NAT	General	Use this screen to enable NAT.
	Port Forwarding	Use this screen to make your local servers visible to the outside world.
	Address Mapping	Use this screen to configure network address translation mapping rules.
	ALG	Use this screen to enable or disable SIP ALG.
VoIP		
SIP	SIP Settings	Use this screen to configure your ZyXEL Device’s Voice over IP settings.
	QoS	Use this screen to configure your ZyXEL Device’s Quality of Service settings for VoIP.
Phone	Analog Phone	Use this screen to set which phone ports use which SIP accounts.
	Common	Use this screen to configure general phone port settings.
	Region	Use this screen to select your location and call service mode.
Phone Book	Speed Dial	Use this screen to configure speed dial for SIP phone numbers that you call often.
	Incoming Call Policy	Use this screen to configure call-forwarding.
PSTN Line (“L” models only)	General	Use this screen to configure your ZyXEL Device’s settings for PSTN calls.
Security		

Table 5 Navigation Panel Summary

LINK	TAB	FUNCTION
Firewall	General	Use this screen to activate/deactivate the firewall and the default action to take on network traffic going in specific directions.
	Rules	This screen shows a summary of the firewall rules, and allows you to edit/ add a firewall rule.
	Threshold	Use this screen to configure the thresholds for determining when to drop sessions that do not become fully established.
Content Filter	Keyword	Use this screen to block access to web sites containing certain keywords in the URL.
	Schedule	Use this screen to set the days and times for your device to perform content filtering.
	Trusted	Use this screen to exclude a range of users on the LAN from content filtering.
VPN	Setup	Use this screen to configure each VPN tunnel.
	Monitor	Use this screen to look at the current status of each VPN tunnel.
	VPN Global Setting	Use this screen to allow NetBIOS traffic through VPN tunnels.
Certificates	My Certificates	Use this screen to generate and export self-signed certificates or certification requests and import the ZyXEL Device's CA-signed certificates.
	Trusted CAs	Use this screen to save CA certificates to the ZyXEL Device.
	Trusted Remote Hosts	Use this screen to import self-signed certificates.
	Directory Servers	Use this screen to configure a list of addresses of directory servers (that contain lists of valid and revoked certificates).
Advanced		
Static Route	IP Static Route	Use this screen to configure IP static routes to tell your device about networks beyond the directly connected remote nodes.
QoS	General	Use this screen to enable QoS and traffic prioritizing, and configure bandwidth management on the WAN.
	Class Setup	Use this screen to define a classifier.
	Monitor	Use this screen to view each queue's statictics.
Dynamic DNS		This screen allows you to use a static hostname alias for a dynamic IP address.
Remote MGMT	WWW	Use this screen to configure through which interface(s) and from which IP address(es) users can use HTTP to manage the ZyXEL Device.
	Telnet	Use this screen to configure through which interface(s) and from which IP address(es) users can use Telnet to manage the ZyXEL Device.
	FTP	Use this screen to configure through which interface(s) and from which IP address(es) users can use FTP to access the ZyXEL Device.
	SNMP	Use this screen to configure your ZyXEL Device's settings for Simple Network Management Protocol management.
	DNS	Use this screen to configure through which interface(s) and from which IP address(es) users can send DNS queries to the ZyXEL Device.
	ICMP	Use this screen to set whether or not your device will respond to pings and probes for services that you have not made available.
UPnP	General	Use this screen to turn UPnP on or off.

Table 5 Navigation Panel Summary

LINK	TAB	FUNCTION
Maintenance		
System	General	Use this screen to configure your device's name, domain name, management inactivity timeout and password.
	Time Setting	Use this screen to change your ZyXEL Device's time and date.
Logs	View Log	Use this screen to display your device's logs.
	Log Settings	Use this screen to select which logs and/or immediate alerts your device is to record. You can also set it to e-mail the logs to you.
Tools	Firmware	Use this screen to upload firmware to your device.
	Configuration	Use this screen to backup and restore your device's configuration (settings) or reset the factory default settings.
	Restart	This screen allows you to reboot the ZyXEL Device without turning the power off.
Diagnostic	General	Use this screen to test the connections to other devices.
	DSL Line	These screen displays information to help you identify problems with the DSL connection.

2.2.3 Main Window

The main window displays information and configuration fields. It is discussed in the rest of this document.

Right after you log in, the **Status** screen is displayed. See Chapter 5 on page 73 for more information about the **Status** screen.

2.2.4 Status Bar

Check the status bar when you click **Apply** or **OK** to verify that the configuration has been updated.

PART II
Wizard

Internet and Wireless Setup Wizard (53)
VoIP Wizard And Example (65)

3

Internet and Wireless Setup Wizard

This chapter provides information on the Wizard Setup screens for Internet access in the web configurator.

3.1 Introduction

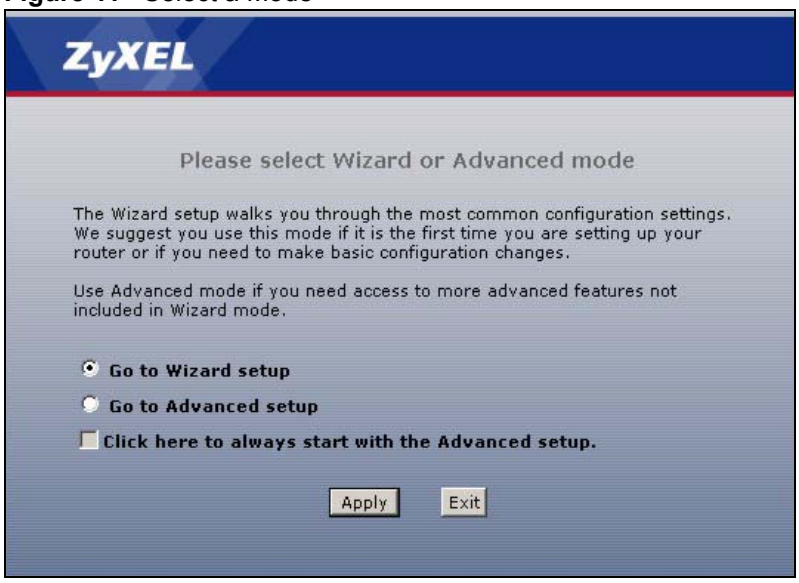
Use the wizard setup screens to configure your system for Internet access with the information given to you by your ISP.

See the advanced menu chapters for background information on these fields.

3.2 Internet Access Wizard Setup

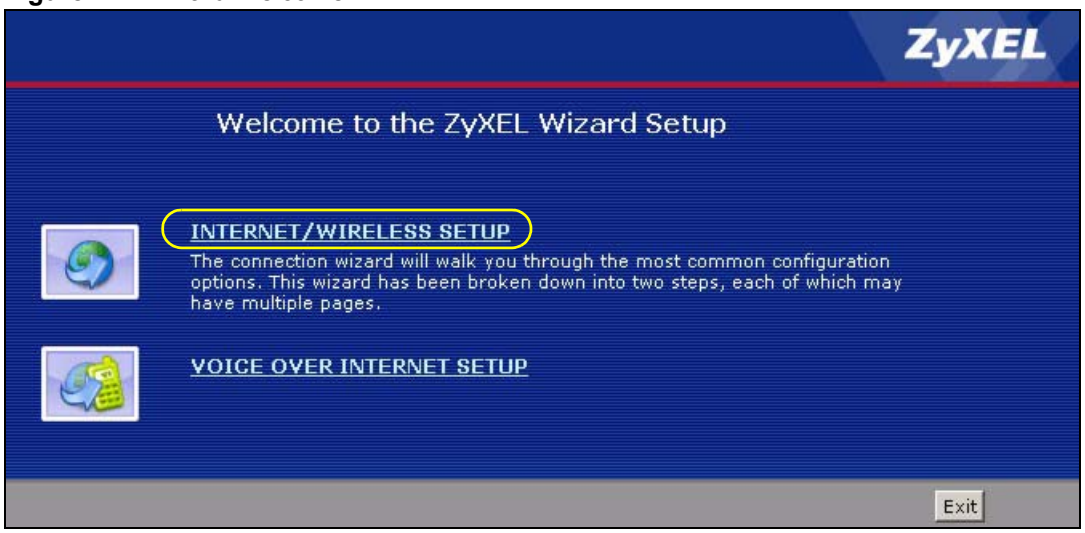
1 After you enter the password to access the web configurator, select **Go to Wizard setup** and click **Apply**. Otherwise, click the wizard icon ( ) in the top right corner of the web configurator to go to the wizards.

Figure 11 Select a Mode


ZyXEL
Please select Wizard or Advanced mode
The Wizard setup walks you through the most common configuration settings. We suggest you use this mode if it is the first time you are setting up your router or if you need to make basic configuration changes.
Use Advanced mode if you need access to more advanced features not included in Wizard mode.
Go to Wizard setup
Go to Advanced setup
Click here to always start with the Advanced setup.
Apply
Exit

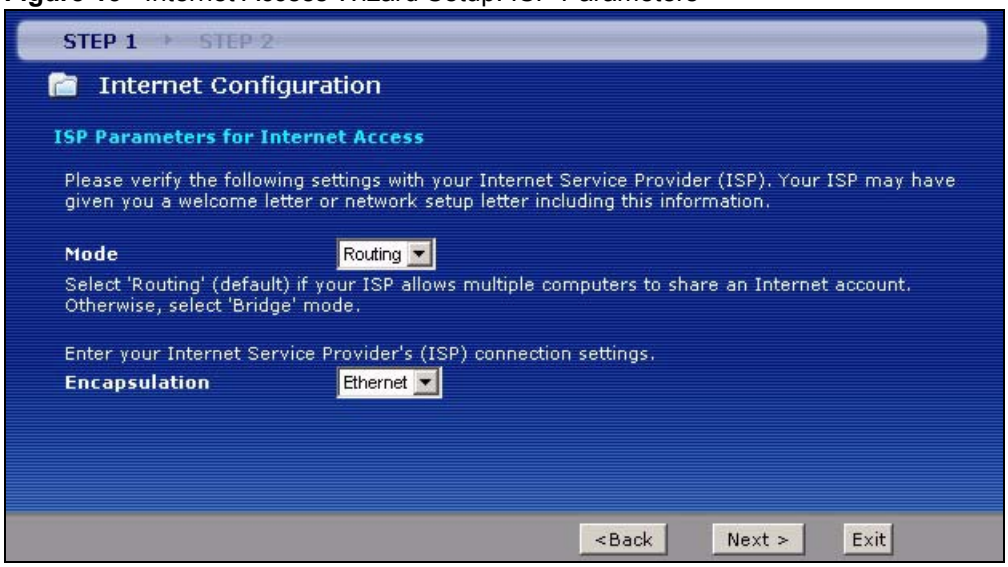
2 Click **INTERNET/WIRELESS SETUP** to configure the system for Internet access and wireless connection.

Figure 12 Wizard Welcome


ZyXEL
Welcome to the ZyXEL Wizard Setup
INTERNET/WIRELESS SETUP
The connection wizard will walk you through the most common configuration options. This wizard has been broken down into two steps, each of which may have multiple pages.
VOICE OVER INTERNET SETUP
Exit

3 Enter your Internet access information in the wizard screen exactly as your service provider gave it to you. Leave the defaults in any fields for which you were not given information.

Figure 13 Internet Access Wizard Setup: ISP Parameters


STEP 1
STEP 2
Internet Configuration
ISP Parameters for Internet Access
Please verify the following settings with your Internet Service Provider (ISP). Your ISP may have given you a welcome letter or network setup letter including this information.
Mode
Routing
Select 'Routing' (default) if your ISP allows multiple computers to share an Internet account. Otherwise, select 'Bridge' mode.
Enter your Internet Service Provider's (ISP) connection settings.
Encapsulation
Ethernet
<Back
Next >
Exit

The following table describes the fields in this screen.

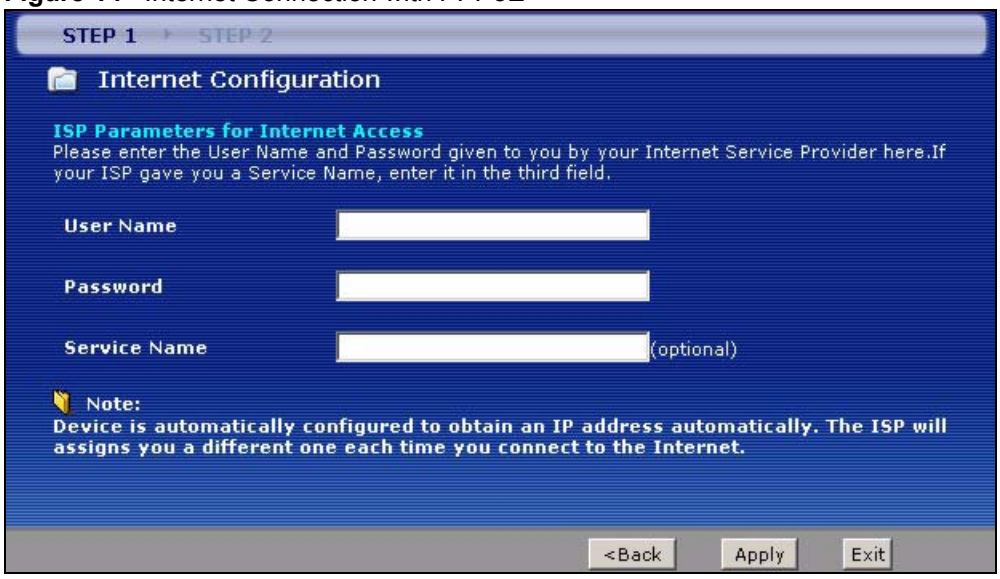
Table 6 Internet Access Wizard Setup: ISP Parameters

LABEL	DESCRIPTION
Mode	Select **Routing** (default) from the drop-down list box if your ISP give you one IP address only and you want multiple computers to share an Internet account. Select **Bridge** when your ISP provides you more than one IP address and you want the connected computers to get individual IP address from ISP's DHCP server directly. If you select **Bridge**, you cannot use Firewall, QoS, DHCP server and NAT on the ZyXEL Device.
Encapsulation	Select the encapsulation type your ISP uses from the **Encapsulation** drop-down list box. This field is available only when you select **Routing** in the **Mode** field. Choices are **Ethernet** and **PPPoE**.
Back	Click **Back** to go back to the previous screen.
Next	Click **Next** to continue to the next wizard screen. The next wizard screen you see depends on what protocol you chose above.
Exit	Click **Exit** to close the wizard screen without saving your changes.

4 The next wizard screen varies depending on what mode and encapsulation type you use. All screens shown are with routing mode. Configure the fields and click **Next** to continue. See Section 3.3 on page 58 for wireless connection wizard setup

When you use the connection wizard to configure the Internet access using PPPoE, the ZyXEL Device is set to get an IP address from the ISP automatically. To set up a static WAN IP address with PPPoE, use the **Network > WAN** screen.

Figure 14 Internet Connection with PPPoE

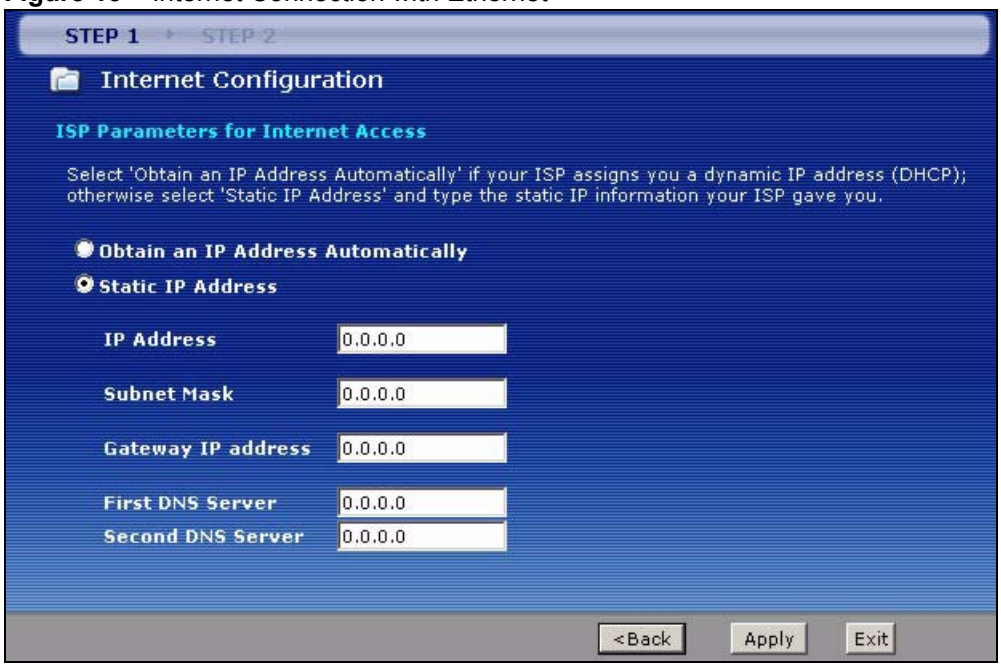

STEP 1
STEP 2
Internet Configuration
ISP Parameters for Internet Access
Please enter the User Name and Password given to you by your Internet Service Provider here.If your ISP gave you a Service Name, enter it in the third field.
User Name
Password
Service Name
(optional)
Note:
Device is automatically configured to obtain an IP address automatically. The ISP will assigns you a different one each time you connect to the Internet.
<Back
Apply
Exit

The following table describes the fields in this screen.

Table 7 Internet Connection with PPPoE

LABEL	DESCRIPTION
User Name	Enter the user name exactly as your ISP assigned. If assigned a name in the form user@domain where domain identifies a service name, then enter both components exactly as given.
Password	Enter the password associated with the user name above.
Service Name	Type the name of your PPPoE service here.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

Figure 15 Internet Connection with Ethernet



The following table describes the fields in this screen.

Table 8 Internet Connection with Ethernet

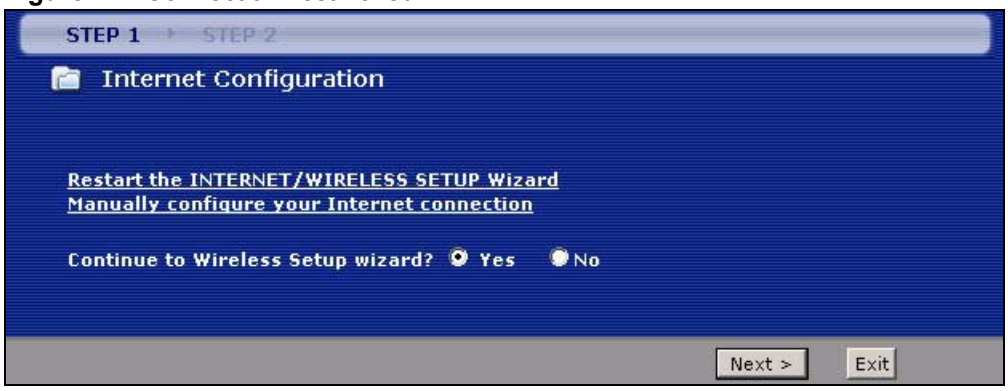
LABEL	DESCRIPTION
Obtain an IP Address Automatically	A static IP address is a fixed IP that your ISP gives you. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet. Select **Obtain an IP Address Automatically** if you have a dynamic IP address.
Static IP Address	Select **Static IP Address** if your ISP gave you an IP address to use.
IP Address	Enter your ISP assigned IP address.
Subnet Mask	Enter a subnet mask in dotted decimal notation. Refer to the appendix to calculate a subnet mask If you are implementing subnetting.
Gateway IP address	You must specify a gateway IP address (supplied by your ISP) when you use **Ethernet** in the **Encapsulation** field in the previous screen.
First DNS Server	Enter the IP addresses of the DNS servers. The DNS servers are passed to the DHCP clients along with the IP address and the subnet mask.
Second DNS Server	As above.
Back	Click **Back** to go back to the previous wizard screen.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Exit	Click **Exit** to close the wizard screen without saving your changes.

5 Wait for the ZyXEL Device to finish testing your WAN connection.

Figure 16 Connection Test

- If the following screen displays, check if your account is activated or click **Restart the Internet/Wireless Setup Wizard** to verify your Internet access settings.

Figure 17 Connection Test Failed .

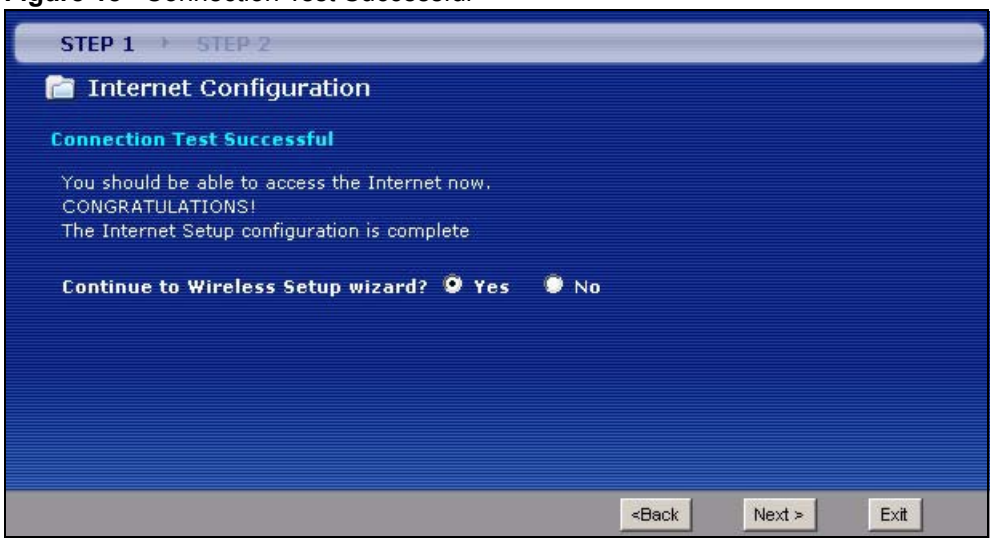


3.3 Wireless Connection Wizard Setup

After you configure the Internet access information, use the following screens to set up your wireless LAN.

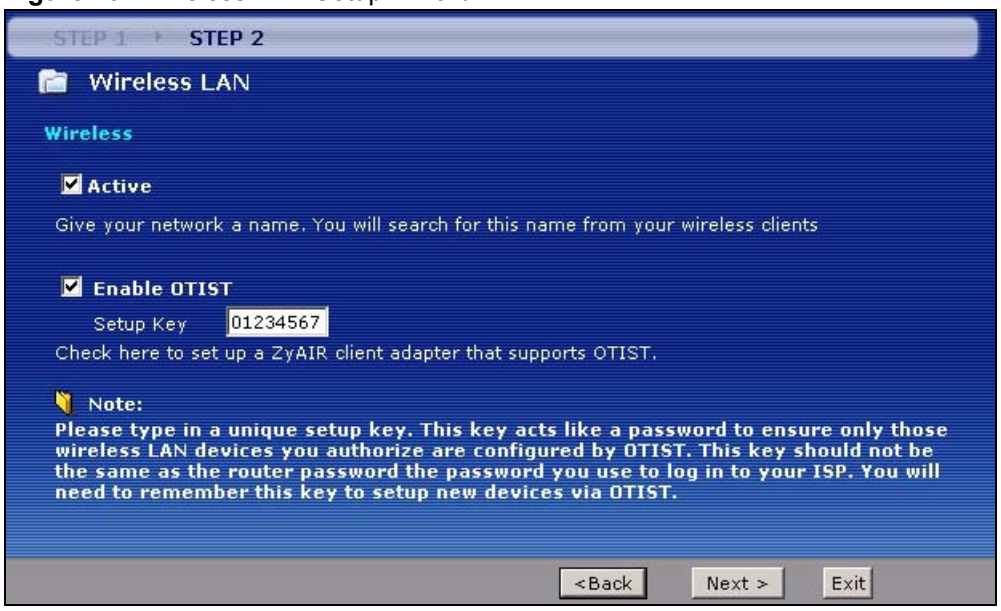
1 Select **Yes** and click **Next** to configure wireless settings. Otherwise, select **No** and skip to Step 6.

Figure 18 Connection Test Successful



2 Use this screen to activate the wireless LAN and OTIST. Click **Next** to continue.

Figure 19 Wireless LAN Setup Wizard 1


STEP 1
STEP 2
Wireless LAN
Wireless
Active
Give your network a name. You will search for this name from your wireless clients
Enable OTIST
Setup Key
01234567
Check here to set up a ZyAIR client adapter that supports OTIST.
Note:
Please type in a unique setup key. This key acts like a password to ensure only those wireless LAN devices you authorize are configured by OTIST. This key should not be the same as the router password the password you use to log in to your ISP. You will need to remember this key to setup new devices via OTIST.
<Back
Next >
Exit

The following table describes the labels in this screen.

Table 9 Wireless LAN Setup Wizard 1

LABEL	DESCRIPTION
Active	Select the check box to turn on the wireless LAN.
Enable OTIST	Select the check box to enable OTIST if you want to transfer your ZyXEL Device's SSID and WEP or WPA-PSK security settings to wireless clients that support OTIST and are within transmission range. You must also activate and start OTIST on the wireless client at the same time. The process takes three minutes to complete.
Setup Key	Type an OTIST **Setup Key** of up to eight ASCII characters in length. Be sure to use the same OTIST **Setup Key** on the ZyXEL Device and wireless clients.
Back	Click **Back** to display the previous screen.

Table 9 Wireless LAN Setup Wizard 1

LABEL	DESCRIPTION
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

3 Configure your wireless settings in this screen. Click **Next**.

Figure 20 Wireless LAN

STEP 1
STEP 2
Wireless LAN
Wireless
Network Name(SSID)
ZyXEL
Give your network a name. You will search for this name from your wireless clients.
Channel Selection
Channel-06 2437MHz
Your router can use one of several channels. You should use the default channel unless other wireless networks nearby use the same channel.
Security
Disable wireless security
Disabling wireless security will leave your network unprotected.
<Back
Next >
Exit

The following table describes the labels in this screen.

Table 10 Wireless LAN Setup Wizard 2

LABEL	DESCRIPTION
Network Name(SSID)	Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN. If you change this field on the ZyXEL Device, make sure all wireless stations use the same SSID in order to access the network.
Channel Selection	The range of radio frequencies used by IEEE 802.11b/g wireless devices is called a channel. Select a channel ID that is not already in use by a neighboring device.
Security	Select **Automatically assign a WPA key (Recommended) (only available if you enable OTIST)** if you want OTIST to configure a WPA key for you. Select **Manually assign a WPA-PSK key** to configure a Pre-Shared Key (WPA-PSK). Choose this option only if your wireless clients support WPA. See Section 3.3.1 on page 61 for more information. Select **Manually assign a WEP key** to configure a WEP Key. See Section 3.3.2 on page 61 for more information. Select **Disable wireless security** to have no wireless LAN security configured and your network is accessible to any wireless networking device that is within range.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

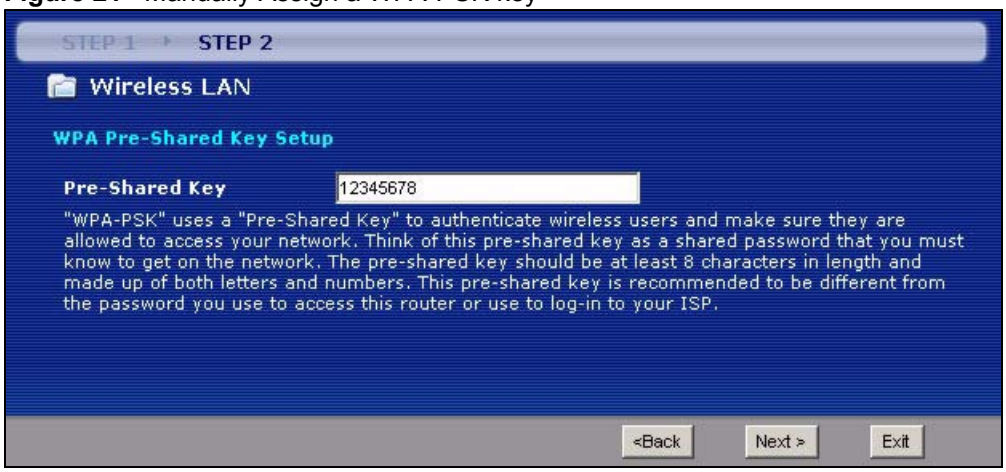
The wireless stations and ZyXEL Device must use the same SSID, channel ID and WEP encryption key (if WEP is enabled), WPA-PSK (if WPA-PSK is enabled) for wireless communication.

4 This screen varies depending on the security mode you selected in the previous screen. Fill in the field (if available) and click **Next**.

3.3.1 Manually Assign a WPA-PSK key

Choose **Manually assign a WPA-PSK key** in the Wireless LAN setup screen to set up a **Pre-Shared Key**.

Figure 21 Manually Assign a WPA-PSK key


STEP 1
STEP 2
Wireless LAN
WPA Pre-Shared Key Setup
Pre-Shared Key
12345678
"WPA-PSK" uses a "Pre-Shared Key" to authenticate wireless users and make sure they are allowed to access your network. Think of this pre-shared key as a shared password that you must know to get on the network. The pre-shared key should be at least 8 characters in length and made up of both letters and numbers. This pre-shared key is recommended to be different from the password you use to access this router or use to log-in to your ISP.
<Back
Next >
Exit

The following table describes the labels in this screen.

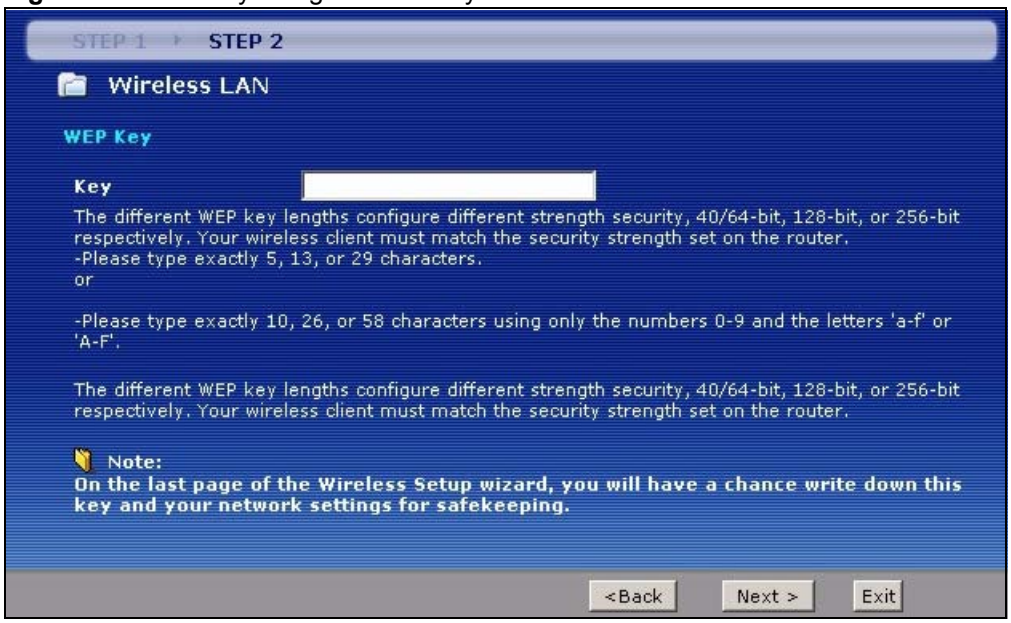
Table 11 Manually Assign a WPA-PSK key

LABEL	DESCRIPTION
Pre-Shared Key	Type from 8 to 63 case-sensitive ASCII characters. You can set up the most secure wireless connection by configuring WPA in the wireless LAN screens. You need to configure an authentication server to do this.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

3.3.2 Manually Assign a WEP Key

Choose **Manually assign a WEP key** to setup WEP Encryption parameters.

Figure 22 Manually Assign a WEP key


STEP 1
STEP 2
Wireless LAN
WEP Key
Key
The different WEP key lengths configure different strength security, 40/64-bit, 128-bit, or 256-bit respectively. Your wireless client must match the security strength set on the router.
-Please type exactly 5, 13, or 29 characters.
or
-Please type exactly 10, 26, or 58 characters using only the numbers 0-9 and the letters 'a-f' or 'A-F'.
The different WEP key lengths configure different strength security, 40/64-bit, 128-bit, or 256-bit respectively. Your wireless client must match the security strength set on the router.
Note:
On the last page of the Wireless Setup wizard, you will have a chance write down this key and your network settings for safekeeping.
<Back
Next >
Exit

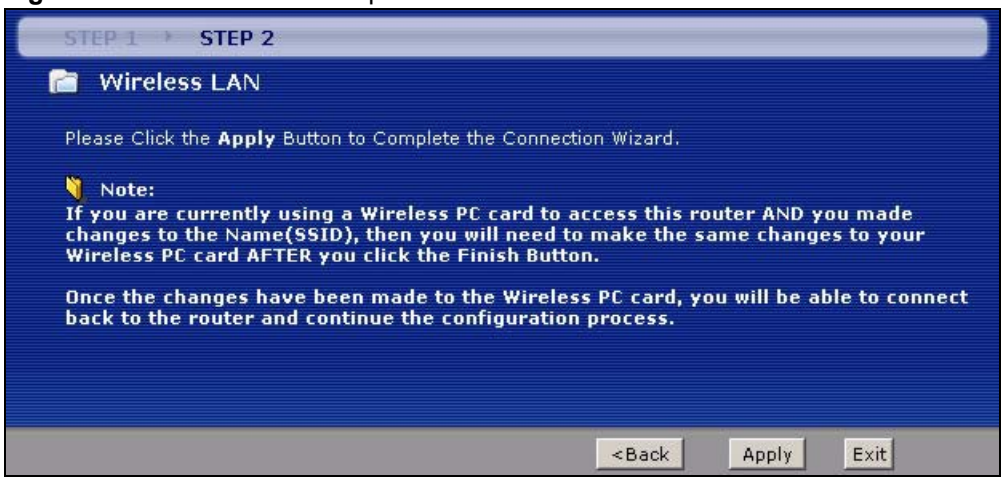
The following table describes the labels in this screen.

Table 12 Manually Assign a WEP key

LABEL	DESCRIPTION
Key	The WEP keys are used to encrypt data. Both the ZyXEL Device and the wireless stations must use the same WEP key for data transmission. Enter any 5, 13 or 29 ASCII characters or 10, 26 or 58 hexadecimal characters ("0-9", "A-F") for a 64-bit, 128-bit or 256-bit WEP key respectively.
Back	Click **Back** to display the previous screen.
Next	Click **Next** to proceed to the next screen.
Exit	Click **Exit** to close the wizard screen without saving.

5 Click **Apply** to save your wireless LAN settings.

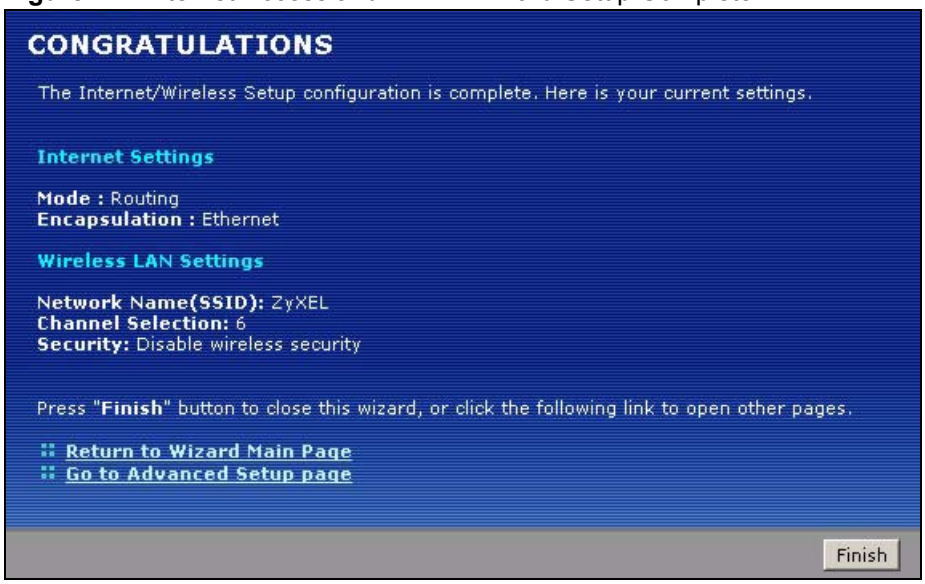
Figure 23 Wireless LAN Setup 3


STEP 1
STEP 2
Wireless LAN
Please Click the Apply Button to Complete the Connection Wizard.
Note:
If you are currently using a Wireless PC card to access this router AND you made changes to the Name(SSID), then you will need to make the same changes to your Wireless PC card AFTER you click the Finish Button.
Once the changes have been made to the Wireless PC card, you will be able to connect back to the router and continue the configuration process.
<Back
Apply
Exit

6 Use the read-only summary table to check whether what you have configured is correct. Click **Finish** to complete and save the wizard setup.

No wireless LAN settings display if you chose not to configure wireless LAN settings.

Figure 24 Internet Access and WLAN Wizard Setup Complete


CONGRATULATIONS
The Internet/Wireless Setup configuration is complete. Here is your current settings.
Internet Settings
Mode : Routing
Encapsulation : Ethernet
Wireless LAN Settings
Network Name(SSID): ZyXEL
Channel Selection: 6
Security: Disable wireless security
Press "Finish" button to close this wizard, or click the following link to open other pages.
Return to Wizard Main Page
Go to Advanced Setup page
Finish

7 Launch your web browser and navigate to www.zyxel.com. Internet access is just the beginning. Refer to the rest of this guide for more detailed information on the complete range of ZyXEL Device features. If you cannot access the Internet, open the web configurator again to confirm that the Internet settings you configured in the wizard setup are correct.

4

VoIP Wizard And Example

This chapter shows you how to configure your SIP account(s) and make a VoIP phone call.

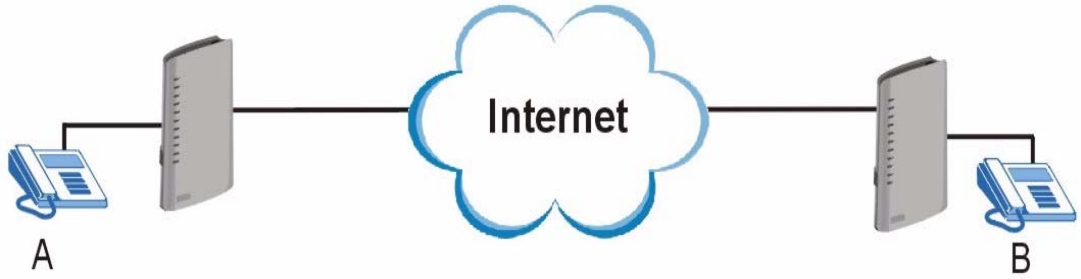
4.1 Introduction

The ZyXEL Device has Voice over IP (VoIP) communication capabilities that allow you to use a traditional analog telephone to make Internet calls. You can configure the ZyXEL Device to use up to two SIP based VoIP accounts.

This section describes how you can set up your ZyXEL Device to call someone who is also using a VoIP device. Make sure your telephone is connected to the **PHONE 1** port before you start with our example.

In the following figure, **A** represents your phone and **B** represents the phone of the person you would like to call.

Figure 25 VoIP Phone Calls



In order to make VoIP calls you need to register at least one SIP account on your ZyXEL Device. You can register your SIP account in the **VOICE OVER INTERNET SETUP** wizard.

4.2 VoIP Wizard Setup

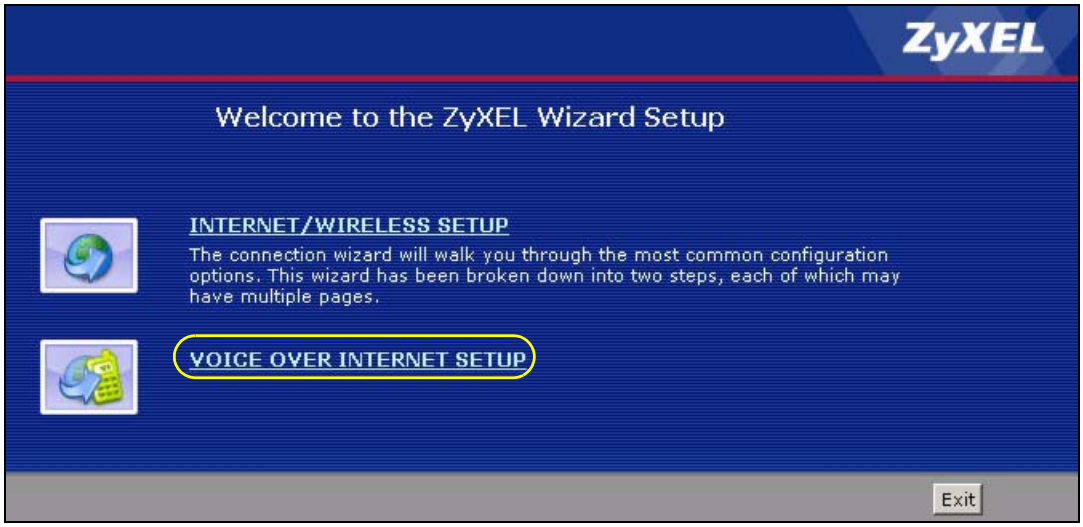
1 After you enter the password to access the web configurator, select **Go to Wizard setup** and click **Apply**. Otherwise, click the wizard icon ( ) in the top right corner of the web configurator to display the wizard main screen.

Figure 26 Select a Mode

ZyXEL
Please select Wizard or Advanced mode
The Wizard setup walks you through the most common configuration settings. We suggest you use this mode if it is the first time you are setting up your router or if you need to make basic configuration changes.
Use Advanced mode if you need access to more advanced features not included in Wizard mode.
Go to Wizard setup
Go to Advanced setup
Click here to always start with the Advanced setup.
Apply
Exit

2 Click **VOICE OVER INTERNET SETUP** to configure your SIP settings.

Figure 27 Wizard: Welcome


ZyXEL
Welcome to the ZyXEL Wizard Setup
INTERNET/WIRELESS SETUP
The connection wizard will walk you through the most common configuration options. This wizard has been broken down into two steps, each of which may have multiple pages.
VOICE OVER INTERNET SETUP
Exit

3 Fill in the **VOICE OVER INTERNET SETUP** wizard screen with the information provided by your VoIP service provider. Your VoIP service provider supplies you with the following information. When you are finished, click **Apply**.

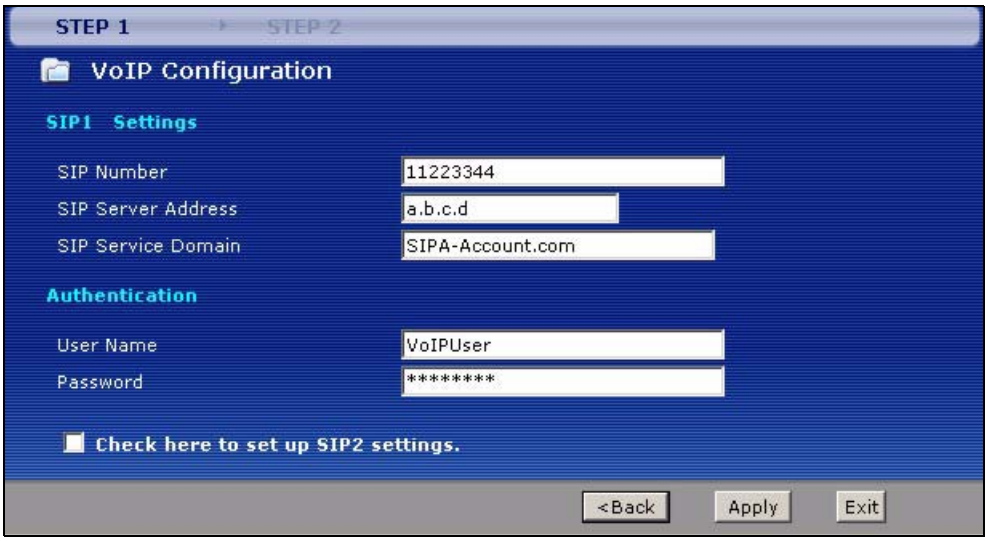
Table 13 Sample SIP Account Information

INFORMATION FROM VOIP SERVICE PROVIDER	EXAMPLE VALUES	DESCRIPTION
SIP account address	11223344@SIPA-Account.com	**11223344** is your SIP number. This is the part that comes before the "@" symbol in your SIP account address. **SIPA-Account.com** is your SIP server domain.
SIP server address	a.b.c.d	**a.b.c.d** is the IP address or domain name of your SIP server.

Table 13 Sample SIP Account Information

INFORMATION FROM VOIP SERVICE PROVIDER	EXAMPLE VALUES	DESCRIPTION
Username	VoIPUser	This is the username you use to login to your SIP account.
Password	Password	This is the password you use to login to your SIP account.

Figure 28 VoIP Wizard Configuration



The following table describes the labels in this screen.

Table 14 VoIP Wizard Configuration

LABEL	DESCRIPTION
SIP Number	Enter your SIP number in this field. Use the number or text that comes before the @ symbol in a SIP account. If your SIP account is 11223344@SIPA-Account.com, your SIP number is “11223344”. You can use up to 127 ASCII characters.
SIP Server Address	Type the IP address or domain name of the SIP server in this field. It doesn’t matter whether the SIP server is a proxy, redirect or register server. You can use up to 95 ASCII characters.
SIP Service Domain	Enter the SIP service domain name in this field (the domain name that comes after the @ symbol in a SIP account like 11223344@SIPA-Account.com). You can use up to 127 ASCII Extended set characters.
User Name	This is the name used to register this SIP account with the SIP register server. Type the user name exactly as it was given to you. You can use up to 95 ASCII characters.
Password	Type the password associated with the user name above. You can use up to 95 ASCII Extended set characters.

Table 14 VoIP Wizard Configuration

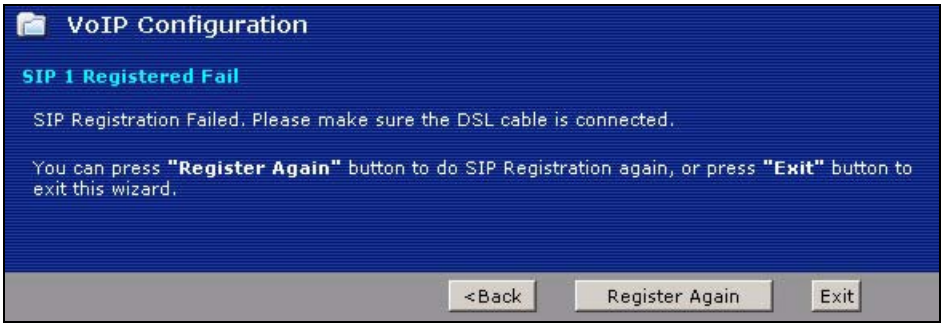
LABEL	DESCRIPTION
Check here to set up SIP2 settings.	This screen configures SIP account 1. Select the check box if you have a second SIP account that you want to use. You will need to configure the same fields for the second SIP account. Note: If you configure more than one SIP account, you need to configure **Analog Phone** settings to distinguish between the two accounts when you make and receive phone calls.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to complete the wizard setup and save your configuration.
Exit	Click **Exit** to close the wizard without saving your settings.

4 Your ZyXEL Device will attempt to register your SIP account with your VoIP service provider. When your account is registered your **PHONE 1** light will come on and you are ready to make and receive VoIP phone calls.

Figure 29 SIP Registration Test

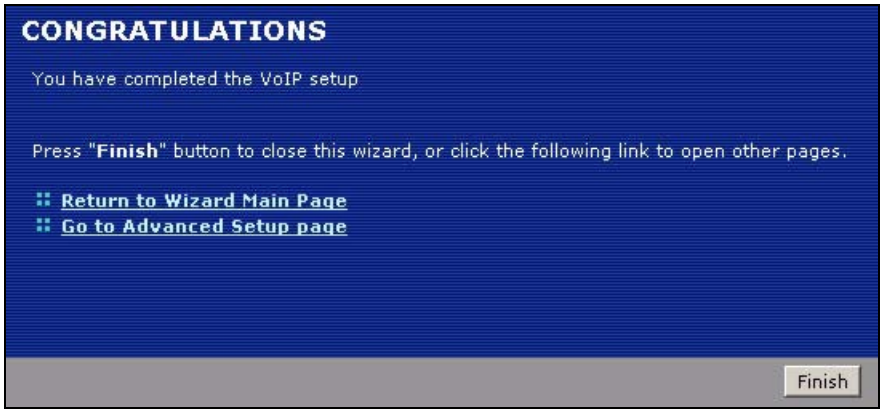
5 This screen displays if SIP account registration fails. If your DSL cable was disconnected, you can try connecting it. Then wait a few seconds and click **Register Again**. If your Internet connection was already working, you can click **Back** and try re-entering your SIP account settings.

Figure 30 VoIP Wizard Fail


VoIP Configuration
SIP 1 Registered Fail
SIP Registration Failed. Please make sure the DSL cable is connected.
You can press "Register Again" button to do SIP Registration again, or press "Exit" button to exit this wizard.
<Back
Register Again
Exit

6 This screen displays if your SIP account registration was successful. Click **Return to Wizard Main Page** if you want to use another configuration wizard. Click **Go to Advanced Setup page** or **Finish** to close the wizard and go to the main web configurator screens.

Figure 31 VoIP Wizard Finish


CONGRATULATIONS
You have completed the VoIP setup
Press "Finish" button to close this wizard, or click the following link to open other pages.
Return to Wizard Main Page
Go to Advanced Setup page
Finish

7 To call other VoIP users, you need to follow a similar process to ensure that their SIP account is registered and active. After it is registered, they need to provide you with their SIP number. You can use your VoIP service provider's dialing plan to call SIP numbers.

You can also use your VoIP service provider's dialing plan to call regular phone numbers. You dial a prefix number, provided to you by your VoIP service provider, followed by a regular phone number.

To find out more information about configuring your VoIP features and making non-VoIP calls see Chapter 10 on page 129.

PART III
Advanced

Status Screens (73)
WAN Setup (83)
LAN Setup (89)
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5

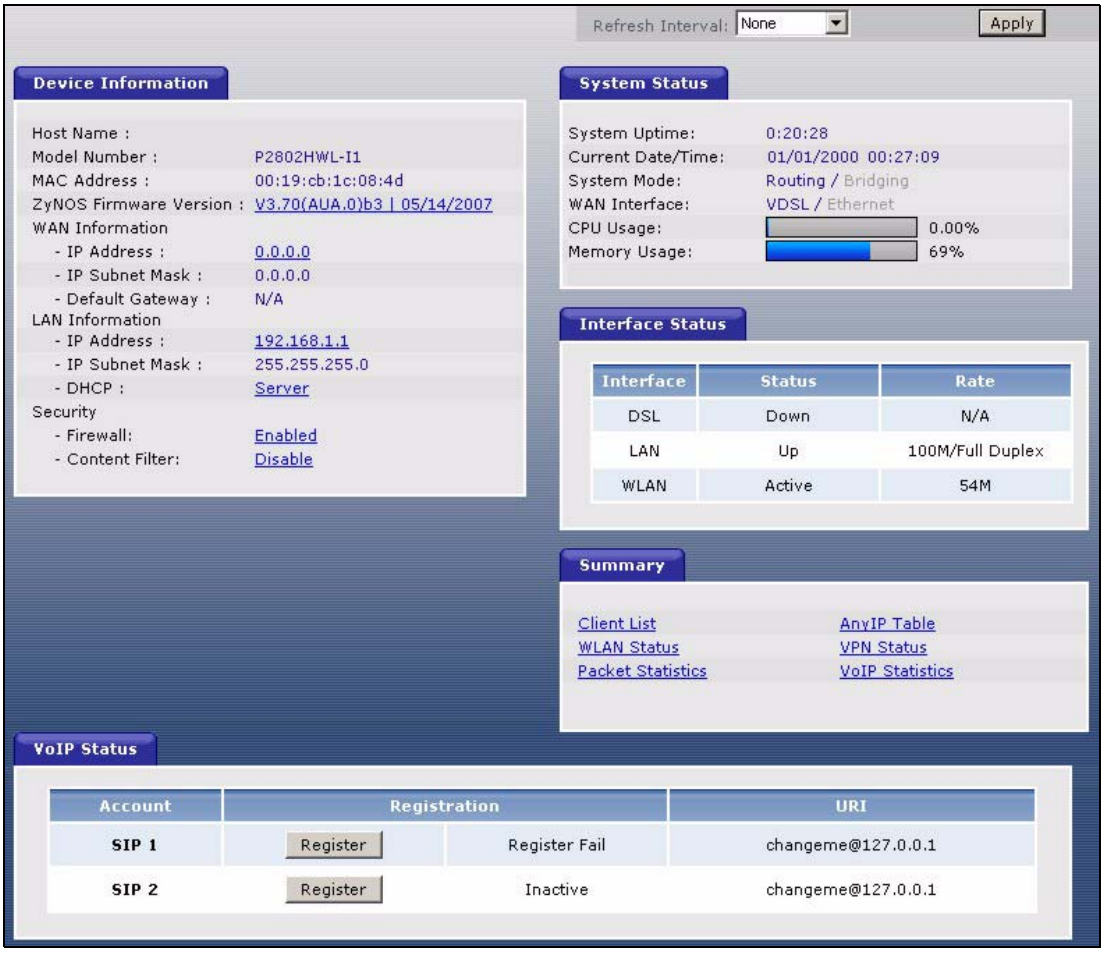
Status Screens

Use the **Status** screens to look at the current status of the device, system resources, interfaces (LAN and WAN), and SIP accounts. You can also register and unregister SIP accounts. The **Status** screen also provides detailed information from Any IP and DHCP and statistics from VoIP, bandwidth management, and traffic.

5.1 Status Screen

Click **Status** to open this screen.

Figure 32 Status Screen



Each field is described in the following table.

Table 15 Status Screen

LABEL	DESCRIPTION
Refresh Interval	Enter how often you want the ZyXEL Device to update this screen.
Apply	Click this to update this screen immediately.
Device Information	
Host Name	This field displays the ZyXEL Device system name. It is used for identification. You can change this in the **Maintenance > System > General** screen's **System Name** field.
Model Number	This is the model name of your device.
MAC Address	This is the MAC (Media Access Control) or Ethernet address unique to your ZyXEL Device.
ZyNOS Firmware Version	This field displays the version of the current firmware and model code. It also shows the date the firmware version was created. Click the hyperlink to go to a screen where you can change it.
WAN Information	
IP Address	This field displays the current IP address of the ZyXEL Device in the WAN. Click the hyperlink to go to a screen where you can upload new firmware.
IP Subnet Mask	This field displays the current subnet mask in the WAN.
Default Gateway	This is the IP address of the default gateway, if applicable.
LAN Information	
IP Address	This field displays the current IP address of the ZyXEL Device LAN port. Click this to go to the screen where you can change it.
IP Subnet Mask	This field displays the current subnet mask of the LAN port.
DHCP	This field displays what DHCP services the ZyXEL Device is providing to the LAN. Choices are: **Server** - The ZyXEL Device is a DHCP server in the LAN. It assigns IP addresses to Ethernet devices in the LAN. **Relay** - The ZyXEL Device acts as a surrogate DHCP server and relays DHCP requests and responses between the remote server and the clients. **None** - The ZyXEL Device is not providing any DHCP services to the LAN. Click the hyperlink to go to a screen where you can change DHCP settings.
WLAN Information	("W" models only)
SSID	This is the descriptive name used to identify the ZyXEL Device in the wireless LAN. Click this to go to the screen where you can change it.
Channel	This is the channel number used by the ZyXEL Device now.
Security	This displays the type of security mode the ZyXEL Device is using in the wireless LAN.
Security	
Firewall	This displays whether or not the ZyXEL Device's firewall is activated. Click this to go to the screen where you can change it.
Content Filter	This displays whether or not the ZyXEL Device's content filtering is activated. Click this to go to the screen where you can change it.

Table 15 Status Screen

LABEL	DESCRIPTION
System Status	
System Uptime	This field displays how long the ZyXEL Device has been running since it last started up. The ZyXEL Device starts up when you plug it in, when you restart it (**Maintenance > Tools > Restart**), or when you reset it (see Section 1.6 on page 41).
Current Date/ Time	This field displays the current date and time in the ZyXEL Device. You can change this in **Maintenance > System > Time Setting**.
System Mode	This displays whether the ZyXEL Device is functioning as a router or a bridge. The ZyXEL Device is always in routing mode when the first Ethernet port is the WAN port to allow Internet access via an Ethernet connection to a broadband modem or router.
WAN Interface	This displays whether the ZyXEL Device is using the VDSL port for Internet access (**VDSL**) or using the first Ethernet port as the WAN port (**Ethernet**).
CPU Usage	This field displays what percentage of the ZyXEL Device's processing ability is currently used. When this percentage is close to 100%, the ZyXEL Device is running at full load, and the throughput is not going to improve anymore. If you want some applications to have more throughput, you should turn off other applications (for example, using QoS; see Chapter 17 on page 239).
Memory Usage	This field displays what percentage of the ZyXEL Device's memory is currently used. Usually, this percentage should not increase much. If memory usage does get close to 100%, the ZyXEL Device is probably becoming unstable, and you should restart the device. See Section 23.6 on page 309, or turn off the device (unplug the power) for a few seconds.
Interface Status	
Interface	This column displays each interface the ZyXEL Device has.
Status	This field indicates whether or not the ZyXEL Device is using the interface. For the DSL interface, this field displays **Down** if you're using Ethernet encapsulation or the DSL port is disabled and **Down** (line is down), **Up** (line is up or connected), **Idle** (line (ppp) idle), **Dial** (starting to trigger a call) and **Drop** (dropping a call) if you're using PPPoE encapsulation. For the LAN interface, this field displays **Up** when the ZyXEL Device is using the interface and **Down** when the ZyXEL Device is not using the interface. For the WLAN interface, it displays **Active** when WLAN is enabled or **Inactive** when WLAN is disabled.
Rate	For the LAN interface, this displays the port speed and duplex setting. For the DSL interface, it displays the downstream and upstream transmission rate or **N/A** when the DSL port is disabled. For the WLAN interface, it displays the maximum transmission rate when WLAN is enabled or **N/A** when WLAN is disabled.
Summary	
Client List	Click this link to view current DHCP client information. See Section 7.6 on page 97.
AnyIP Table	Click this link to view a list of IP addresses and MAC addresses of computers, which are not in the same subnet as the ZyXEL Device. See Section 5.2 on page 76.
WLAN Status	Click this link to display the MAC address(es) of the wireless stations that are currently associating with the ZyXEL Device. See Section 5.3 on page 77.
VPN Status	Click this link to view the ZyXEL Device's current VPN connections. See Section 14.16 on page 205.

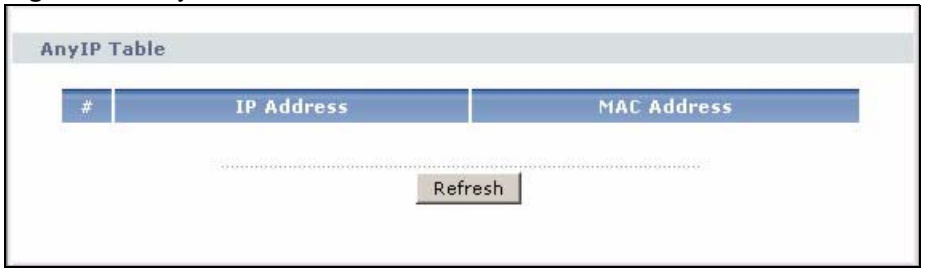
Table 15 Status Screen

LABEL	DESCRIPTION
Packet Statistics	Click this link to view port status and packet specific statistics. See Section 5.4 on page 77.
VoIP Statistics	Click this link to view statistics about your VoIP usage. See Section 5.5 on page 79.
VoIP Status	
Account	This column displays each SIP account in the ZyXEL Device.
Registration	This field displays the current registration status of the SIP account. You have to register SIP accounts with a SIP server to use VoIP. If the SIP account is already registered with the SIP server, • Click **Unregister** to delete the SIP account's registration in the SIP server. This does not cancel your SIP account, but it deletes the mapping between your SIP identity and your IP address or domain name. • The second field displays **Registered**. If the SIP account is not registered with the SIP server, • Click **Register** to have the ZyXEL Device attempt to register the SIP account with the SIP server. • The second field displays the reason the account is not registered. **Inactive** - The SIP account is not active. You can activate it in **VoIP > SIP > SIP Settings**. **Register Fail** - The last time the ZyXEL Device tried to register the SIP account with the SIP server, the attempt failed. The ZyXEL Device automatically tries to register the SIP account when you turn on the ZyXEL Device or when you activate it.
URI	This field displays the account number and service domain of the SIP account. You can change these in **VoIP > SIP > SIP Settings**.

5.2 Any IP Table

Click **Status > AnyIP Table** to access this screen. Use this screen to view the IP address and MAC address of each computer that is using the ZyXEL Device but is in a different subnet than the ZyXEL Device.

Figure 33 Any IP Table



Each field is described in the following table.

Table 16 Any IP Table

LABEL	DESCRIPTION
#	This field is a sequential value. It is not associated with a specific entry.
IP Address	This field displays the IP address of each computer that is using the ZyXEL Device but is in a different subnet than the ZyXEL Device.

Table 16 Any IP Table

LABEL	DESCRIPTION
MAC Address	This field displays the MAC address of the computer that is using the ZyXEL Device but is in a different subnet than the ZyXEL Device.
Refresh	Click this to update this screen.

5.3 WLAN Status ("W" models only)

Click **Status > WLAN Status** to access this screen. Use this screen to view the wireless stations that are currently associated to the ZyXEL Device.

Figure 34 WLAN Status

The following table describes the labels in this screen.

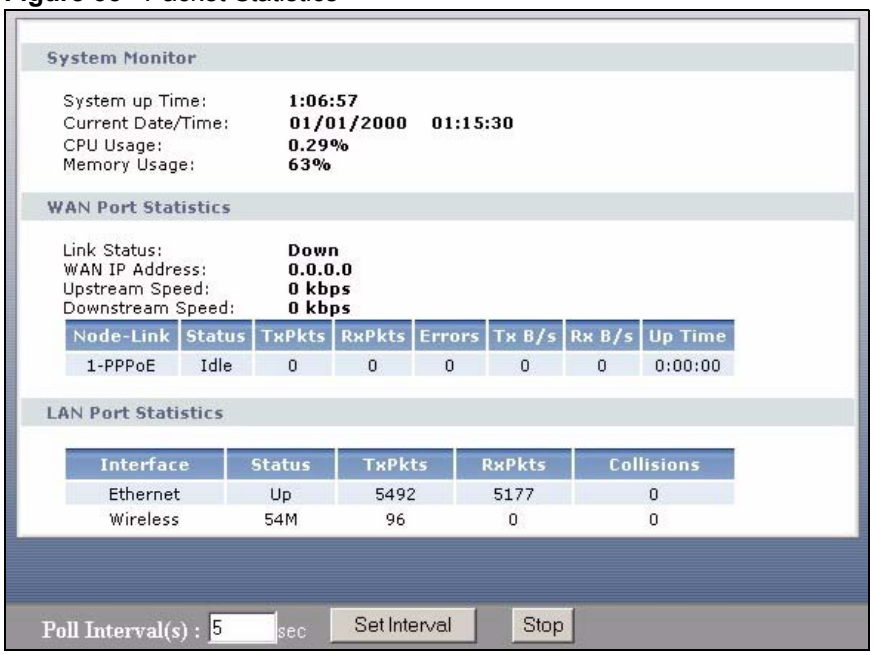
Table 17 WLAN Status

LABEL	DESCRIPTION
#	This is the index number of an associated wireless station.
MAC Address	This field displays the MAC (Media Access Control) address of an associated wireless station.
Association TIme	This field displays the time a wireless station first associated with the ZyXEL Device.
Refresh	Click **Refresh** to reload this screen.

5.4 Packet Statistics

Click **Status > Packet Statistics** to access this screen. Read-only information here includes port status and packet specific statistics. Also provided are "system up time" and "poll interval(s)". The **Poll Interval(s)** field is configurable.

Figure 35 Packet Statistics


System Monitor
System up Time: 1:06:57
Current Date/Time: 01/01/2000 01:15:30
CPU Usage: 0.29%
Memory Usage: 63%
WAN Port Statistics
Link Status: Down
WAN IP Address: 0.0.0.0
Upstream Speed: 0 kbps
Downstream Speed: 0 kbps
Node-Link Status TxPkts RxPkts Errors Tx B/s Rx B/s Up Time
1-PPPoE Idle 0 0 0 0 0 0:00:00
LAN Port Statistics
Interface Status TxPkts RxPkts Collisions
Ethernet Up 5492 5177 0
Wireless 54M 96 0 0
Poll Interval(s) : 5 sec
Set Interval
Stop

The following table describes the fields in this screen.

Table 18 Packet Statistics

LABEL	DESCRIPTION
System Monitor	
System up Time	This is the elapsed time the system has been up.
Current Date/Time	This field displays your ZyXEL Device's present date and time.
CPU Usage	This field specifies the percentage of CPU utilization.
Memory Usage	This field specifies the percentage of memory utilization.
WAN Port Statistics	
Link Status	This is the status of your WAN link.
WAN IP Address	This is the IP address of the ZyXEL Device's WAN port.
Upstream Speed	This is the upstream speed of your ZyXEL Device.
Downstream Speed	This is the downstream speed of your ZyXEL Device.
Node-Link	This field displays the remote node index number and link type. Link types are DHCP (Ethernet) and PPPoE.
Status	This field displays **Down** (line is down), **Up** (line is up or connected) if you're using Ethernet encapsulation and **Down** (line is down), **Up** (line is up or connected), **Idle** (line (ppp) idle), **Dial** (starting to trigger a call) and **Drop** (dropping a call) if you're using PPPoE encapsulation.
TxPkts	This field displays the number of packets transmitted on this port.
RxPkts	This field displays the number of packets received on this port.
Errors	This field displays the number of error packets on this port.
Tx B/s	This field displays the number of bytes transmitted in the last second.
Rx B/s	This field displays the number of bytes received in the last second.
Up Time	This field displays the elapsed time this port has been up.
LAN Port Statistics	

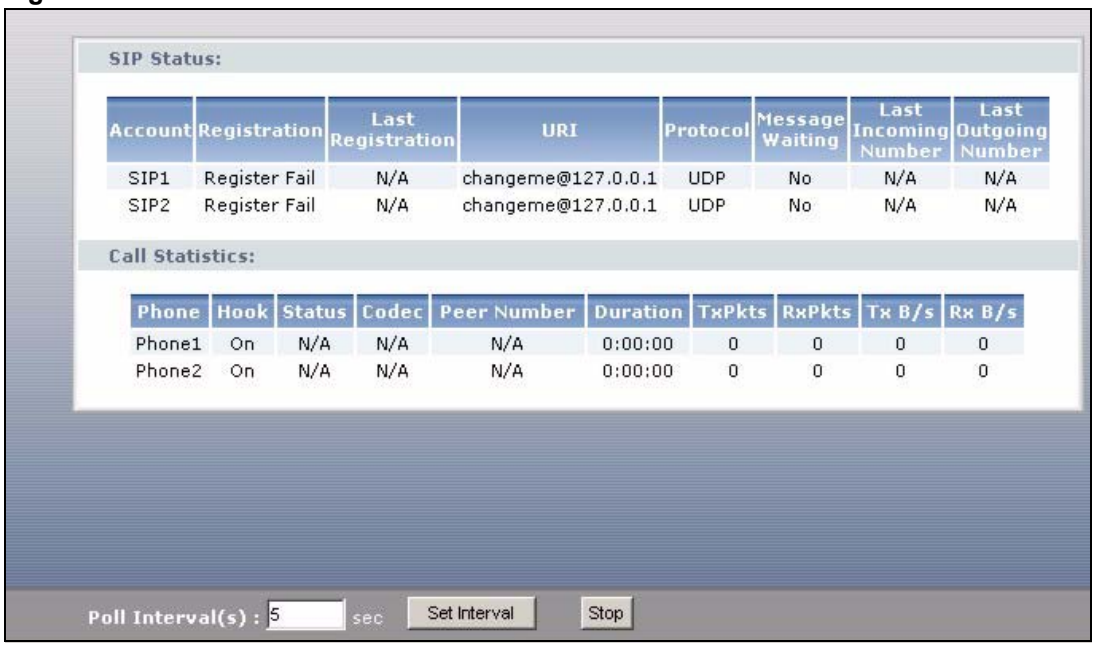
Table 18 Packet Statistics (continued)

LABEL	DESCRIPTION
Interface	This field displays either **Ethernet** (LAN ports) or **Wireless** (WLAN port).
Status	For the LAN ports, this field displays **Down** (line is down) or **Up** (line is up or connected). For the WLAN port, it displays the transmission rate when WLAN is enabled or **N/A** when WLAN is disabled.
TxPkts	This field displays the number of packets transmitted on this interface.
RxPkts	This field displays the number of packets received on this interface.
Collisions	This is the number of collisions on this interfaces.
Poll Interval(s)	Type the time interval for the browser to refresh system statistics.
Set Interval	Click this to apply the new poll interval you entered in the **Poll Interval** field above.
Stop	Click this button to halt the refreshing of the system statistics.

5.5 VoIP Statistics

Click **Status > VoIP Statistics** to access this screen.

Figure 36 VoIP Statistics



Each field is described in the following table.

Table 19 VoIP Statistics

LABEL	DESCRIPTION
SIP Status	
Account	This column displays each SIP account in the ZyXEL Device.

Table 19 VoIP Statistics

LABEL	DESCRIPTION
Registration	This field displays the current registration status of the SIP account. You can change this in the **Status** screen. **Registered** - The SIP account is registered with a SIP server. **Register Fail** - The last time the ZyXEL Device tried to register the SIP account with the SIP server, the attempt failed. The ZyXEL Device automatically tries to register the SIP account when you turn on the ZyXEL Device or when you activate it. **Inactive** - The SIP account is not active. You can activate it in **VoIP > SIP > SIP Settings**.
Last Registration	This field displays the last time you successfully registered the SIP account. It displays **N/A** if you never successfully registered this account.
URI	This field displays the account number and service domain of the SIP account. You can change these in **VoIP > SIP > SIP Settings**.
Protocol	This field displays the transport protocol the SIP account uses. SIP accounts always use UDP.
Message Waiting	This field indicates whether or not there are any messages waiting for the SIP account.
Last Incoming Number	This field displays the last number that called the SIP account. It displays **N/A** if no number has ever dialed the SIP account.
Last Outgoing Number	This field displays the last number the SIP account called. It displays **N/A** if the SIP account has never dialed a number.
Call Statistics	
Phone	This field displays each phone port in the ZyXEL Device.
Hook	This field indicates whether the phone is on the hook or off the hook. **On** - The phone is hanging up or already hung up. **Off** - The phone is dialing, calling, or connected.
Status	This field displays the current state of the phone call. **N/A** - There are no current VoIP calls, incoming calls or outgoing calls being made. **DIAL** - The callee's phone is ringing. **RING** - The phone is ringing for an incoming VoIP call. **Process** - There is a VoIP call in progress. **DISC** - The callee's line is busy, the callee hung up or your phone was left off the hook.
Codec	This field displays what voice codec is being used for a current VoIP call through a phone port.
Peer Number	This field displays the SIP number of the party that is currently engaged in a VoIP call through a phone port.
Duration	This field displays how long the current call has lasted.
Tx Pkts	This field displays the number of packets the ZyXEL Device has transmitted in the current call.
Rx Pkts	This field displays the number of packets the ZyXEL Device has received in the current call.
Tx B/s	This field displays how quickly the ZyXEL Device has transmitted packets in the current call. The rate is the average number of bytes transmitted per second.
Rx B/s	This field displays how quickly the ZyXEL Device has received packets in the current call. The rate is the average number of bytes transmitted per second.

Table 19 VoIP Statistics

LABEL	DESCRIPTION
Poll Interval(s)	Enter how often you want the ZyXEL Device to update this screen, and click **Set Interval**.
Set Interval	Click this to make the ZyXEL Device update the screen based on the amount of time you specified in **Poll Interval**.
Stop	Click this to make the ZyXEL Device stop updating the screen.

6

WAN Setup

This chapter describes how to configure WAN settings.

6.1 WAN Overview

A WAN (Wide Area Network) is an outside connection to another network or the Internet.

6.1.1 PPP over Ethernet

The ZyXEL Device supports PPPoE (Point-to-Point Protocol over Ethernet). PPPoE is an IETF Draft standard (RFC 2516) specifying how a personal computer (PC) interacts with a broadband modem (DSL, cable, wireless, etc.) connection. The **PPPoE** option is for a dial-up connection using PPPoE.

For the service provider, PPPoE offers an access and authentication method that works with existing access control systems (for example RADIUS).

One of the benefits of PPPoE is the ability to let you access one of multiple network services, a function known as dynamic service selection. This enables the service provider to easily create and offer new IP services for individuals.

Operationally, PPPoE saves significant effort for both you and the ISP or carrier, as it requires no specific configuration of the broadband modem at the customer site.

By implementing PPPoE directly on the ZyXEL Device (rather than individual computers), the computers on the LAN do not need PPPoE software installed, since the ZyXEL Device does that part of the task. Furthermore, with NAT, all of the LANs' computers will have access.

6.1.2 IP Address Assignment

A static IP is a fixed IP that your ISP gives you. A dynamic IP is not fixed; the ISP assigns you a different one each time. The SUA (Single User Account) feature can be enabled or disabled if you have either a dynamic or static IP. However the encapsulation method assigned influences your choices for IP address and default gateway.

6.1.3 Nailed-Up Connection (PPP)

A nailed-up connection is a dial-up line where the connection is always up regardless of traffic demand. The ZyXEL Device does two things when you specify a nailed-up connection. The first is that idle timeout is disabled. The second is that the ZyXEL Device will try to bring up the connection when turned on and whenever the connection is down. A nailed-up connection can be very expensive for obvious reasons.

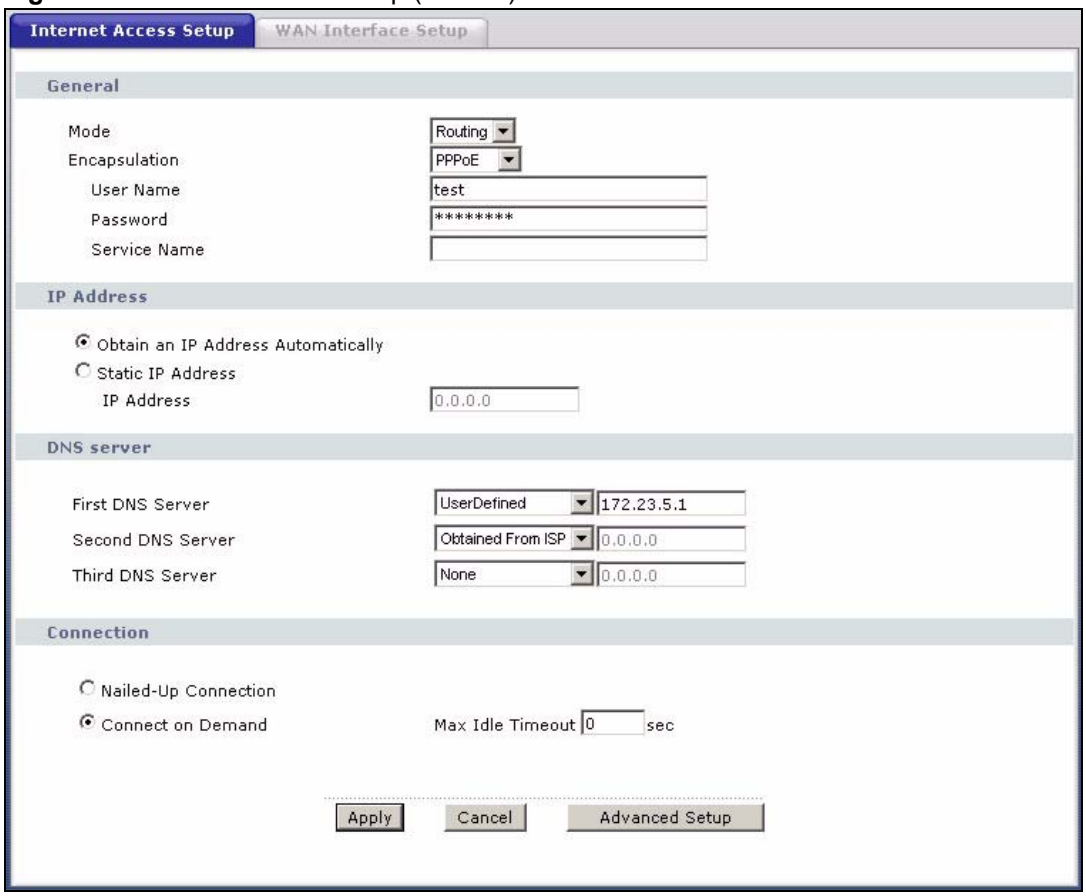
Do not specify a nailed-up connection unless your telephone company offers flat-rate service or you need a constant connection and the cost is of no concern.

6.2 Internet Access Setup

Use this screen to change your ZyXEL Device's WAN settings. Click **Network > WAN > Internet Access Setup**. The screen differs by the encapsulation you select.

See Section 6.1 on page 83 for more information.

Figure 37 Internet Access Setup (PPPoE)



The following table describes the labels in this screen.

Table 20 Internet Access Setup

LABEL	DESCRIPTION
General	
Mode	Select **Routing** (default) from the drop-down list box if your ISP give you one IP address only and you want multiple computers to share an Internet account. Select **Bridge** when your ISP provides you more than one IP address and you want the connected computers to get individual IP address from ISP's DHCP server directly. If you select **Bridge**, you cannot use Firewall, QoS, DHCP server and NAT on the ZyXEL Device. Note: If you set the first Ethernet port as a WAN interface, the ZyXEL Device is always in routing mode and this field will not be configurable.
Encapsulation	Select the method of encapsulation used by your ISP from the drop-down list box. This field is available only when you select **Routing** in the **Mode** field. Choices are **Ethernet** and **PPPoE**.
User Name	(PPPoE encapsulation only) Enter the user name exactly as your ISP assigned. If assigned a name in the form user@domain where domain identifies a service name, then enter both components exactly as given.
Password	(PPPoE encapsulation only) Enter the password associated with the user name above.
Service Name	(PPPoE only) Type the name of your PPPoE service here.
IP Address	This option is available if you select **Routing** in the **Mode** field. A static IP address is a fixed IP that your ISP gives you. A dynamic IP address is not fixed; the ISP assigns you a different one each time you connect to the Internet. Select **Obtain an IP Address Automatically** if you have a dynamic IP address; otherwise select **Static IP Address** and type your ISP assigned IP address in the **IP Address** field below.
IP Address	Enter the IP address assigned by your ISP if you select **Static IP Address**.
Subnet Mask	This field is avavilable when you select **Ethernet** in the **Encapsulation** field. Enter a subnet mask in dotted decimal notation if you select **Static IP Address**.
Gateway IP address	This field is avavilable when you select **Ethernet** in the **Encapsulation** field. Specify a gateway IP address (supplied by your ISP) if you select **Static IP Address**. If you set the first Ethernet port as a WAN port and connect the Ethernet port to a broadband modem or router, enter the broadband modem or router's LAN IP address here.
DNS Server	
First DNS Server Second DNS Server Third DNS Server	Select **Obtained From ISP** if your ISP dynamically assigns DNS server information (and the ZyXEL Device's WAN IP address) and you select **Obtain an IP Address Automatically**. Select **UserDefined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **UserDefined**, but leave the IP address set to 0.0.0.0, **UserDefined** changes to **None** after you click **Apply**. If you set a second choice to **UserDefined**, and enter the same IP address, the second **UserDefined** changes to **None** after you click **Apply**. Select **None** if you do not want to configure DNS servers. You must have another DNS server on your LAN, or else the computers must have their DNS server addresses manually configured. If you do not configure a DNS server, you must know the IP address of a computer in order to access it.

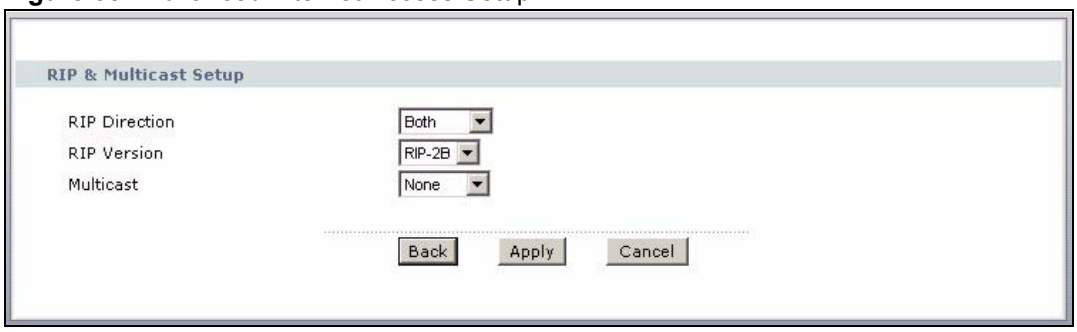
Table 20 Internet Access Setup (continued)

LABEL	DESCRIPTION
Connection (PPPoE encapsulation only)	
Nailed-Up Connection	Select **Nailed-Up Connection** when you want your connection up all the time. The ZyXEL Device will try to bring up the connection automatically if it is disconnected.
Connect on Demand	Select **Connect on Demand** when you don't want the connection up all the time and specify an idle time-out in the **Max Idle Timeout** field.
Max Idle Timeout	Specify an idle time-out in the **Max Idle Timeout** field when you select **Connect on Demand**. The default setting is 0, which means the Internet session will not timeout.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Advanced Setup	Click this button to display the **Advanced WAN Setup** screen and edit more details of your WAN setup.

6.2.1 Advanced Internet Access Setup

Use this screen to edit your ZyXEL Device's advanced WAN settings. Click the **Advanced Setup** button in the **Internet Access Setup** screen. The screen appears as shown.

Figure 38 Advanced Internet Access Setup



The following table describes the labels in this screen.

Table 21 Advanced Internet Access Setup

LABEL	DESCRIPTION
RIP & Multicast Setup	
RIP Direction	RIP (Routing Information Protocol) allows a router to exchange routing information with other routers. Use this field to control how much routing information the ZyXEL Device sends and receives on the subnet. Select the RIP direction from **None**, **Both**, **In Only** and **Out Only**.
RIP Version	Select the RIP version from **RIP-1**, **RIP-2B** and **RIP-2M**.
Multicast	Multicast packets are sent to a group of computers on the LAN and are an alternative to unicast packets (packets sent to one computer) and broadcast packets (packets sent to every computer). IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a multicast group. The ZyXEL Device supports both IGMP version 1 (**IGMP-v1**) and **IGMP-v2**. Select **None** to disable it.

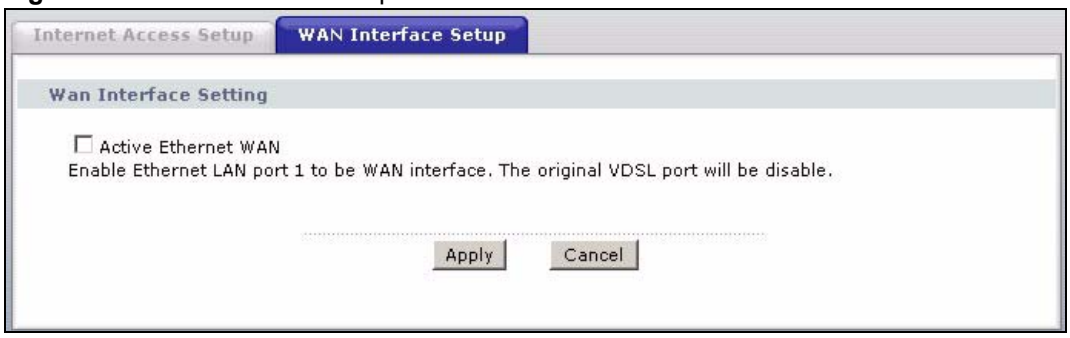
Table 21 Advanced Internet Access Setup (continued)

LABEL	DESCRIPTION
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.

6.3 WAN Interface Setup

Use this screen to configure your ZyXEL Device's WAN interface setting. Click **Network > WAN > WAN Interface Setup**. If you prefer not to use a VDSL line and you have another broadband modem or router (such as ADSL) available, you can set the first Ethernet port as the WAN port and connect that to the broadband modem or router. This way, you can access the Internet via an Ethernet connection and still use the QoS, Firewall and VoIP functions on the ZyXEL Device.

Figure 39 WAN Interface Setup


Internet Access Setup
WAN Interface Setup
Wan Interface Setting
Active Ethernet WAN
Enable Ethernet LAN port 1 to be WAN interface. The original VDSL port will be disable.
Apply
Cancel

The following table describes the labels in this screen.

Table 22 WAN Interface Setup

LABEL	DESCRIPTION
Active Ethernet WAN	Select the check box to set the first Ethernet port as a WAN port. The VDSL port will then be disabled automatically. This allows the ZyXEL Device to work as an Ethernet gateway, instead of a VDSL router. To access the Internet, connect the first Ethernet port to a broadband modem or router. The ZyXEL Device restarts after you select or clear the check box and click **Apply**.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.

7

LAN Setup

This chapter describes how to configure LAN settings.

7.1 LAN Overview

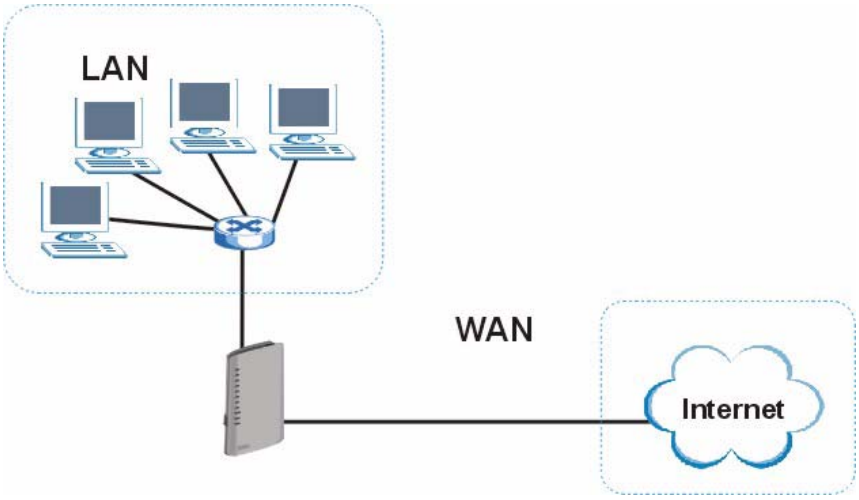
A Local Area Network (LAN) is a shared communication system to which many computers are attached. A LAN is a computer network limited to the immediate area, usually the same building or floor of a building. The LAN screens can help you configure a LAN DHCP server and manage IP addresses.

See Section 7.4 on page 94 to configure the **LAN** screens.

7.1.1 LANs, WANs and the ZyXEL Device

The actual physical connection determines whether the ZyXEL Device ports are LAN or WAN ports. There are two separate IP networks, one inside the LAN network and the other outside the WAN network as shown next.

Figure 40 LAN and WAN IP Addresses



7.1.2 DHCP Setup

DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients to obtain TCP/IP configuration at start-up from a server. You can configure the ZyXEL Device as a DHCP server or disable it. When configured as a server, the ZyXEL Device provides the TCP/IP configuration for the clients. If you turn DHCP service off, you must have another DHCP server on your LAN, or else the computer must be manually configured.

7.1.2.1 IP Pool Setup

The ZyXEL Device is pre-configured with a pool of IP addresses for the DHCP clients (DHCP Pool). See the product specifications in the appendices. Do not assign static IP addresses from the DHCP pool to your LAN computers.

7.2 DNS Server Addresses

DNS (Domain Name System) maps a domain name to its corresponding IP address and vice versa. The DNS server is extremely important because without it, you must know the IP address of a computer before you can access it. The DNS server addresses you enter when you set up DHCP are passed to the client machines along with the assigned IP address and subnet mask.

There are two ways that an ISP disseminates the DNS server addresses.

- The ISP tells you the DNS server addresses, usually in the form of an information sheet, when you sign up. If your ISP gives you DNS server addresses, enter them in the **DNS Server** fields in the **DHCP Setup** screen.
- Some ISPs choose to disseminate the DNS server addresses using the DNS server extensions of IPCP (IP Control Protocol) after the connection is up. If your ISP did not give you explicit DNS servers, chances are the DNS servers are conveyed through IPCP negotiation. The ZyXEL Device supports the IPCP DNS server extensions through the DNS proxy feature.

  If the **DNS Server** fields in the **DHCP Setup** screen are set to **DNS Relay**, the ZyXEL Device tells the DHCP clients that it itself is the DNS server. When a computer sends a DNS query to the ZyXEL Device, the ZyXEL Device acts as a DNS proxy and forwards the query to the real DNS server learned through IPCP and relays the response back to the computer.

  Please note that DNS proxy works only when the ISP uses the IPCP DNS server extensions. It does not mean you can leave the DNS servers out of the DHCP setup under all circumstances. If your ISP gives you explicit DNS servers, make sure that you enter their IP addresses in the **DHCP Setup** screen.

7.3 LAN TCP/IP

The ZyXEL Device has built-in DHCP server capability that assigns IP addresses and DNS servers to systems that support DHCP client capability.

7.3.1 IP Address and Subnet Mask

Similar to the way houses on a street share a common street name, so too do computers on a LAN share one common network number.

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0 and you must enable the Network Address Translation (NAT) feature of the ZyXEL Device. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. Let's say you select 192.168.1.0 as the network number; which covers 254 individual addresses, from 192.168.1.1 to 192.168.1.254 (zero and 255 are reserved). In other words, the first three numbers specify the network number while the last number identifies an individual computer on that network.

Once you have decided on the network number, pick an IP address that is easy to remember, for instance, 192.168.1.1, for your ZyXEL Device, but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your ZyXEL Device will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the ZyXEL Device unless you are instructed to do otherwise.

7.3.1.1 Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet, for example, only between your two branch offices, you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, “Address Allocation for Private Internets” and RFC 1466, “Guidelines for Management of IP Address Space”.

7.3.2 RIP Setup

RIP (Routing Information Protocol) allows a router to exchange routing information with other routers. The **RIP Direction** field controls the sending and receiving of RIP packets. When set to:

- **Both -** the ZyXEL Device will broadcast its routing table periodically and incorporate the RIP information that it receives.
- **In Only -** the ZyXEL Device will not send any RIP packets but will accept all RIP packets received.
- **Out Only -** the ZyXEL Device will send out RIP packets but will not accept any RIP packets received.
- **None -** the ZyXEL Device will not send any RIP packets and will ignore any RIP packets received.

The **Version** field controls the format and the broadcasting method of the RIP packets that the ZyXEL Device sends (it recognizes both formats when receiving). RIP-1 is universally supported; but RIP-2 carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology.

Both RIP-2B and RIP-2M sends the routing data in RIP-2 format; the difference being that RIP-2B uses subnet broadcasting while RIP-2M uses multicasting.

7.3.3 Multicast

Traditionally, IP packets are transmitted in one of either two ways - Unicast (1 sender - 1 recipient) or Broadcast (1 sender - everybody on the network). Multicast delivers IP packets to a group of hosts on the network - not everybody and not just 1.

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. IGMP version 2 (RFC 2236) is an improvement over version 1 (RFC 1112) but IGMP version 1 is still in wide use. If you would like to read more detailed information about interoperability between IGMP version 2 and version 1, please see sections 4 and 5 of RFC 2236. The class D IP address is used to identify host groups and can be in the range 224.0.0.0 to 239.255.255.255. The address 224.0.0.0 is not assigned to any group and is used by IP multicast computers. The address 224.0.0.1 is used for query messages and is assigned to the permanent group of all IP hosts (including gateways). All hosts must join the 224.0.0.1 group in order to participate in IGMP. The address 224.0.0.2 is assigned to the multicast routers group.

The ZyXEL Device supports both IGMP version 1 (**IGMP-v1**) and IGMP version 2 (**IGMP-v2**). At start up, the ZyXEL Device queries all directly connected networks to gather group membership. After that, the ZyXEL Device periodically updates this information. IP multicasting can be enabled/disabled on the ZyXEL Device LAN and/or WAN interfaces in the web configurator (**LAN**; **WAN**). Select **None** to disable IP multicasting on these interfaces.

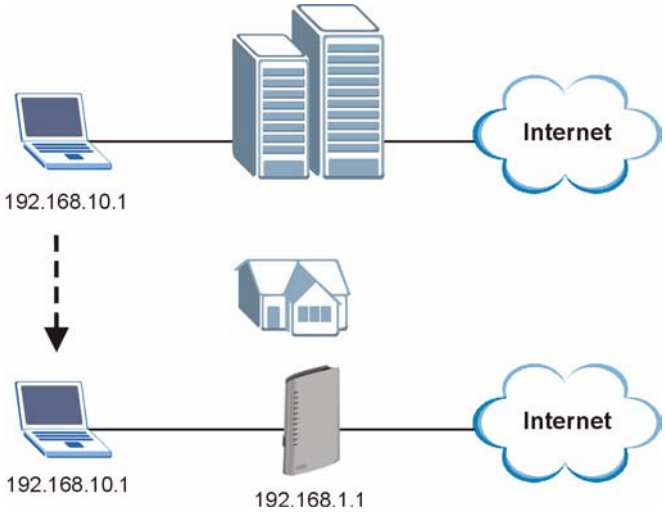
7.3.4 Any IP

Traditionally, you must set the IP addresses and the subnet masks of a computer and the ZyXEL Device to be in the same subnet to allow the computer to access the Internet (through the ZyXEL Device). In cases where your computer is required to use a static IP address in another network, you may need to manually configure the network settings of the computer every time you want to access the Internet via the ZyXEL Device.

With the Any IP feature and NAT enabled, the ZyXEL Device allows a computer to access the Internet without changing the network settings (such as IP address and subnet mask) of the computer, when the IP addresses of the computer and the ZyXEL Device are not in the same subnet. Whether a computer is set to use a dynamic or static (fixed) IP address, you can simply connect the computer to the ZyXEL Device and access the Internet.

The following figure depicts a scenario where a computer is set to use a static private IP address in the corporate environment. In a residential house where a ZyXEL Device is installed, you can still use the computer to access the Internet without changing the network settings, even when the IP addresses of the computer and the ZyXEL Device are not in the same subnet.

Figure 41 Any IP Example



The Any IP feature does not apply to a computer using either a dynamic IP address or a static IP address that is in the same subnet as the ZyXEL Device's IP address.

You must enable NAT/SUA to use the Any IP feature on the ZyXEL Device.

7.3.4.1 How Any IP Works

Address Resolution Protocol (ARP) is a protocol for mapping an Internet Protocol address (IP address) to a physical machine address, also known as a Media Access Control or MAC address, on the local area network. IP routing table is defined on IP Ethernet devices (the ZyXEL Device) to decide which hop to use, to help forward data along to its specified destination.

The following lists out the steps taken, when a computer tries to access the Internet for the first time through the ZyXEL Device.

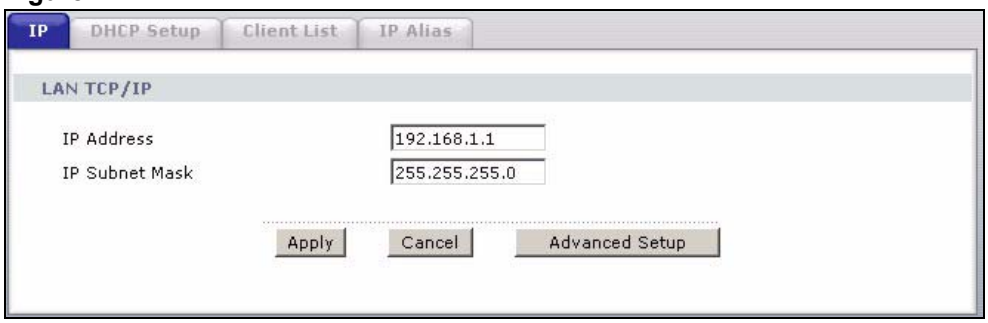
1. When a computer (which is in a different subnet) first attempts to access the Internet, it sends packets to its default gateway (which is not the ZyXEL Device) by looking at the MAC address in its ARP table.
2. When the computer cannot locate the default gateway, an ARP request is broadcast on the LAN.
3. The ZyXEL Device receives the ARP request and replies to the computer with its own MAC address.
4. The computer updates the MAC address for the default gateway to the ARP table. Once the ARP table is updated, the computer is able to access the Internet through the ZyXEL Device.
5. When the ZyXEL Device receives packets from the computer, it creates an entry in the IP routing table so it can properly forward packets intended for the computer.

After all the routing information is updated, the computer can access the ZyXEL Device and the Internet as if it is in the same subnet as the ZyXEL Device.

7.4 Configuring LAN IP

Click **Network > LAN** to open the **IP** screen. See Section 7.1 on page 89 for background information. Use this screen to set the Local Area Network IP address and subnet mask of your ZyXEL Device.

Figure 42 LAN IP



The following table describes the fields in this screen.

Table 23 LAN IP

LABEL	DESCRIPTION
LAN TCP/IP	
IP Address	Enter the LAN IP address you want to assign to your ZyXEL Device in dotted decimal notation, for example, 192.168.1.1 (factory default).
IP Subnet Mask	Type the subnet mask of your network in dotted decimal notation, for example 255.255.255.0 (factory default). Your ZyXEL Device automatically computes the subnet mask based on the IP Address you enter, so do not change this field unless you are instructed to do so.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.

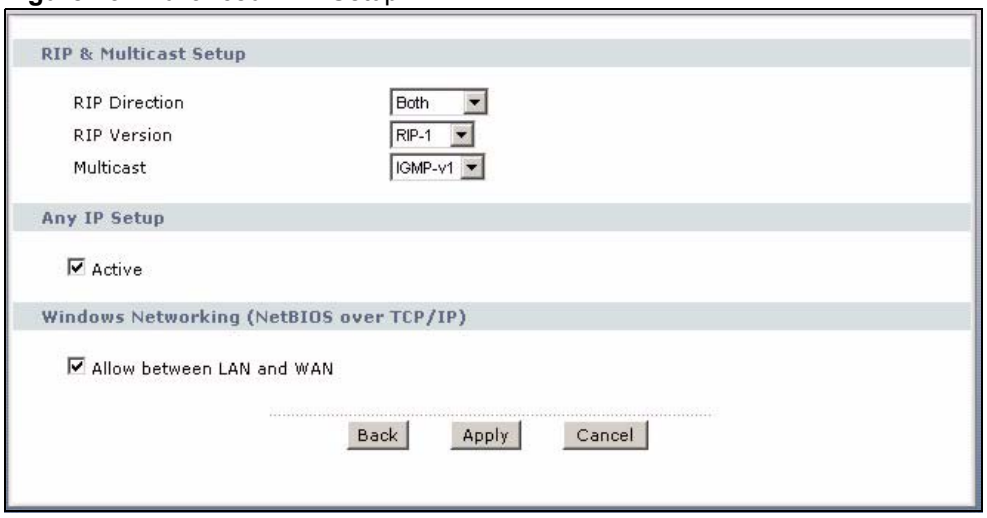
Table 23 LAN IP (continued)

LABEL	DESCRIPTION
Cancel	Click **Cancel** to begin configuring this screen afresh.
Advanced Setup	Click this button to display the **Advanced Setup** screen and edit more details of your LAN setup.

7.4.1 Configuring Advanced LAN Setup

Use this screen to edit your ZyXEL Device's RIP, multicast, any IP and Windows Networking settings. Click the **Advanced Setup** button in the **LAN IP** screen. The screen appears as shown.

Figure 43 Advanced LAN Setup



The following table describes the labels in this screen.

Table 24 Advanced LAN Setup

LABEL	DESCRIPTION
RIP & Multicast Setup	
RIP Direction	Select the RIP direction from **None**, **Both**, **In Only** and **Out Only**.
RIP Version	Select the RIP version from **RIP-1**, **RIP-2B** and **RIP-2M**.
Multicast	IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a multicast group. The ZyXEL Device supports both IGMP version 1 (**IGMP-v1**) and **IGMP-v2**. Select **None** to disable it.
Any IP Setup	Select the **Active** check box to enable the Any IP feature. This allows a computer to access the Internet without changing the network settings (such as IP address and subnet mask) of the computer, even when the IP addresses of the computer and the ZyXEL Device are not in the same subnet. Note: You must enable NAT/SUA to use the Any IP feature on the ZyXEL Device. When you disable the Any IP feature, only computers with dynamic IP addresses or static IP addresses in the same subnet as the ZyXEL Device's LAN IP address can connect to the ZyXEL Device or access the Internet through the ZyXEL Device.

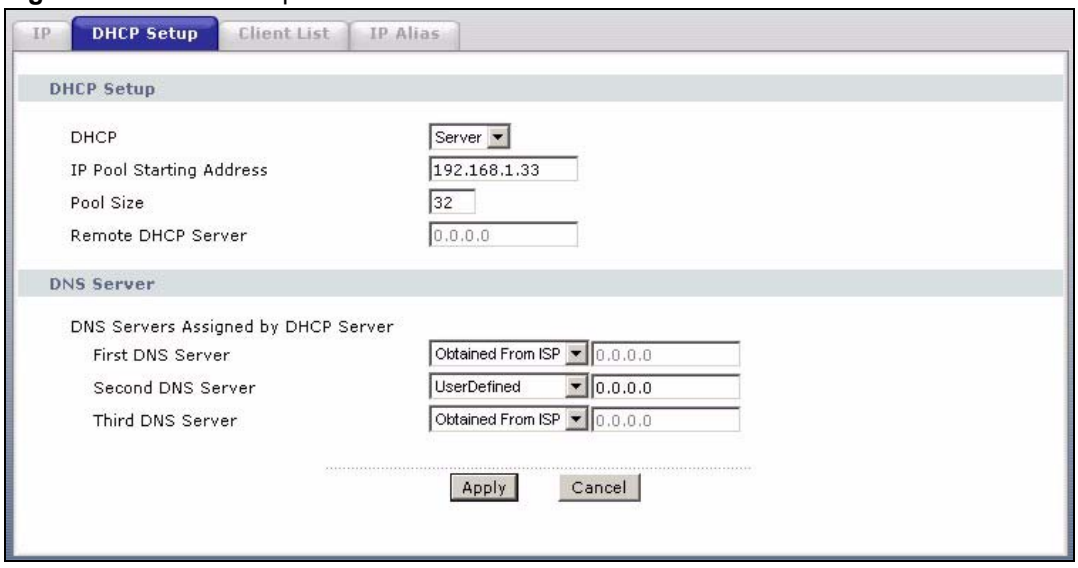
Table 24 Advanced LAN Setup (continued)

LABEL	DESCRIPTION
Windows Networking (NetBIOS over TCP/IP)	NetBIOS (Network Basic Input/Output System) are TCP or UDP packets that enable a computer to connect to and communicate with a LAN. For some dial-up services such as PPPoE or PPTP, NetBIOS packets cause unwanted calls. However it may sometimes be necessary to allow NetBIOS packets to pass through to the WAN in order to find a computer on the WAN.
Allow between LAN and WAN	Select this check box to forward NetBIOS packets from the LAN to the WAN and from the WAN to the LAN. If your firewall is enabled with the default policy set to block WAN to LAN traffic, you also need to enable the default WAN to LAN firewall rule that forwards NetBIOS traffic. Clear this check box to block all NetBIOS packets going from the LAN to the WAN and from the WAN to the LAN.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save the changes.
Cancel	Click **Cancel** to begin configuring this screen afresh.

7.5 DHCP Setup

Click **Network > DHCP Setup** to open this screen. Use this screen to configure the DNS server information that the ZyXEL Device sends to the DHCP client devices on the LAN.

Figure 44 DHCP Setup



The following table describes the labels in this screen.

Table 25 DHCP Setup

LABEL	DESCRIPTION
DHCP Setup	
DHCP	If set to **Server**, your ZyXEL Device can assign IP addresses, an IP default gateway and DNS servers to Windows 95, Windows NT and other systems that support the DHCP client. If set to **None**, the DHCP server will be disabled. If set to **Relay**, the ZyXEL Device acts as a surrogate DHCP server and relays DHCP requests and responses between the remote server and the clients. Enter the IP address of the actual, remote DHCP server in the **Remote DHCP Server** field in this case. When DHCP is used, the following items need to be set:
IP Pool Starting Address	This field specifies the first of the contiguous addresses in the IP address pool.
Pool Size	This field specifies the size, or count of the IP address pool.
Remote DHCP Server	If **Relay** is selected in the **DHCP** field above then enter the IP address of the actual remote DHCP server here.
DNS Server	
DNS Servers Assigned by DHCP Server	The ZyXEL Device passes a DNS (Domain Name System) server IP address to the DHCP clients.
First DNS Server Second DNS Server Third DNS Server	Select **Obtained From ISP** if your ISP dynamically assigns DNS server information (and the ZyXEL Device's WAN IP address). Select **UserDefined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **UserDefined**, but leave the IP address set to 0.0.0.0, **UserDefined** changes to **None** after you click **Apply**. If you set a second choice to **UserDefined**, and enter the same IP address, the second **User-Defined** changes to **None** after you click **Apply**. Select **DNS Relay** to have the ZyXEL Device act as a DNS proxy only when the ISP uses IPCP DNS server extensions. The ZyXEL Device's LAN IP address displays in the field to the right (read-only). The ZyXEL Device tells the DHCP clients on the LAN that the ZyXEL Device itself is the DNS server. When a computer on the LAN sends a DNS query to the ZyXEL Device, the ZyXEL Device forwards the query to the real DNS server learned through IPCP and relays the response back to the computer. You can only select **DNS Relay** for one of the three servers; if you select **DNS Relay** for a second or third DNS server, that choice changes to **None** after you click **Apply**. Select **None** if you do not want to configure DNS servers. You must have another DHCP sever on your LAN, or else the computers must have their DNS server addresses manually configured. If you do not configure a DNS server, you must know the IP address of a computer in order to access it.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

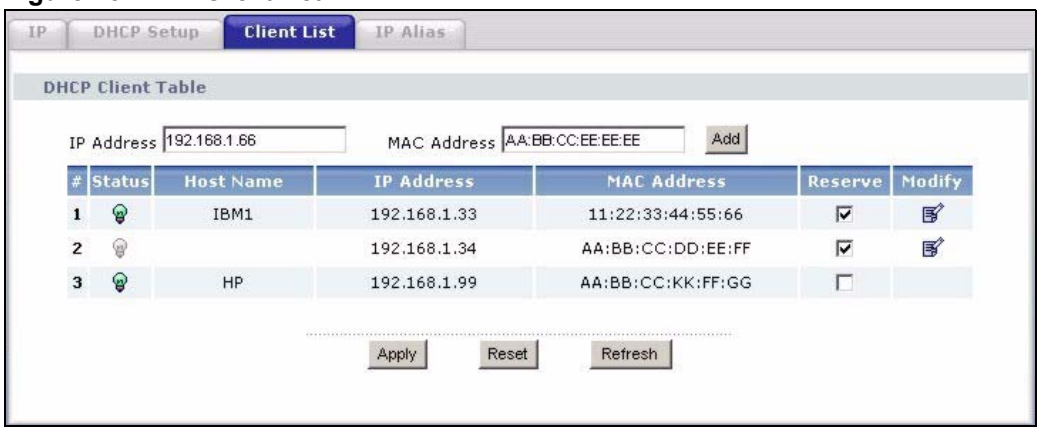
7.6 LAN Client List

This table allows you to assign IP addresses on the LAN to specific individual computers based on their MAC addresses.

Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02.

Click **Network > LAN > Client List** to open the following screen. Use this screen to change your ZyXEL Device's static DHCP settings.

Figure 45 LAN Client List



The following table describes the labels in this screen.

Table 26 LAN Client List

LABEL	DESCRIPTION
IP Address	Enter the IP address that you want to assign to the computer on your LAN with the MAC address that you will also specify.
MAC Address	Enter the MAC address of a computer on your LAN.
Add	Click **Add** to add a static DHCP entry.
#	This is the index number of the static IP table entry (row).
Status	This field displays whether the client is connected to the ZyXEL Device.
Host Name	This field displays the computer host name.
IP Address	This field displays the IP address relative to the # field listed above.
MAC Address	The MAC (Media Access Control) or Ethernet address on a LAN (Local Area Network) is unique to your computer (six pairs of hexadecimal notation). A network interface card such as an Ethernet adapter has a hardwired address that is assigned at the factory. This address follows an industry standard that ensures no other adapter has a similar address.
Reserve	Select the check box in the heading row to automatically select all check boxes or select the check box(es) in each entry to have the ZyXEL Device always assign the selected entry(ies)'s IP address(es) to the corresponding MAC address(es) (and host name(s)). You can select up to 128 entries in this table. After you click **Apply**, the MAC address and IP address also display in the **LAN Static DHCP** screen (where you can edit them).
Modify	Click the modify icon to have the IP address field editable and change it.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Refresh	Click **Refresh** to reload the DHCP table.

7.7 LAN IP Alias

IP alias allows you to partition a physical network into different logical networks over the same Ethernet interface. The ZyXEL Device supports three logical LAN interfaces via its single physical Ethernet interface with the ZyXEL Device itself as the gateway for each LAN network.

When you use IP alias, you can also configure firewall rules to control access between the LAN's logical networks (subnets).

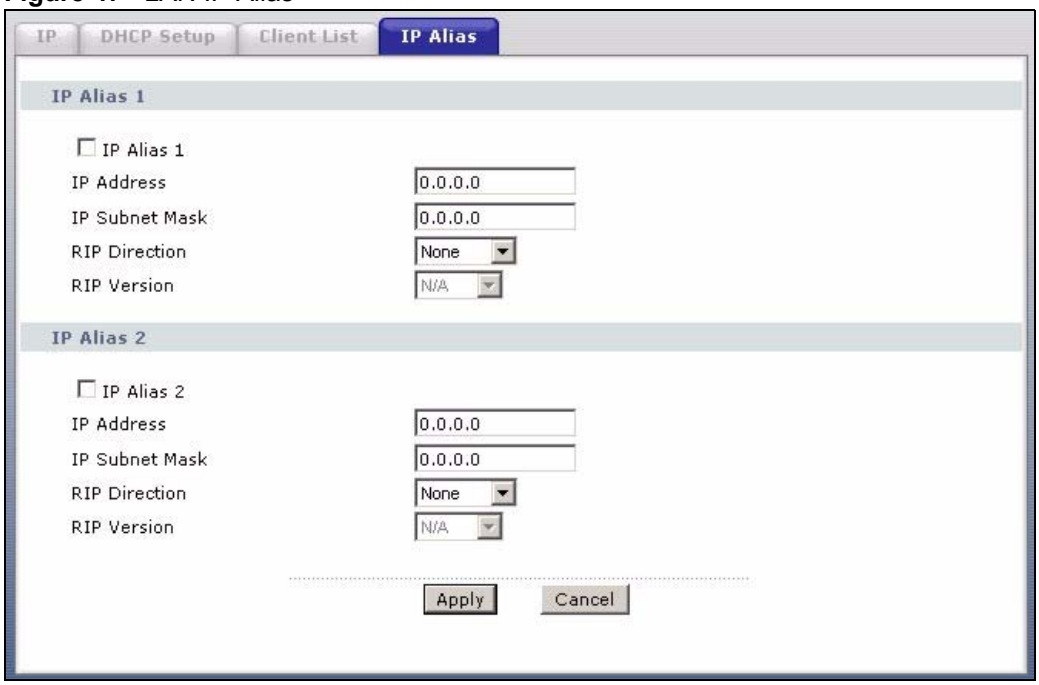
Make sure that the subnets of the logical networks do not overlap.

The following figure shows a LAN divided into subnets A, B, and C.

Figure 46 Physical Network & Partitioned Logical Networks

Click **Network** > **LAN** > **IP Alias** to open the following screen. Use this screen to change your ZyXEL Device's IP alias settings.

Figure 47 LAN IP Alias



The following table describes the labels in this screen.

Table 27 LAN IP Alias

LABEL	DESCRIPTION
IP Alias 1, 2	Select the check box to configure another LAN network for the ZyXEL Device.
IP Address	Enter the IP address of your ZyXEL Device in dotted decimal notation. Alternatively, click the right mouse button to copy and/or paste the IP address.
IP Subnet Mask	Your ZyXEL Device will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the ZyXEL Device.
RIP Direction	RIP (Routing Information Protocol, RFC 1058 and RFC 1389) allows a router to exchange routing information with other routers. The **RIP Direction** field controls the sending and receiving of RIP packets. Select the RIP direction from **Both/In Only/Out Only/None**. When set to **Both** or **Out Only**, the ZyXEL Device will broadcast its routing table periodically. When set to **Both** or **In Only**, it will incorporate the RIP information that it receives; when set to **None**, it will not send any RIP packets and will ignore any RIP packets received.
RIP Version	The **RIP Version** field controls the format and the broadcasting method of the RIP packets that the ZyXEL Device sends (it recognizes both formats when receiving). **RIP-1** is universally supported but RIP-2 carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology. Both **RIP-2B** and **RIP-2M** sends the routing data in RIP-2 format; the difference being that **RIP-2B** uses subnet broadcasting while **RIP-2M** uses multicasting. Multicasting can reduce the load on non-router machines since they generally do not listen to the RIP multicast address and so will not receive the RIP packets. However, if one router uses multicasting, then all routers on your network must use multicasting, also. By default, RIP direction is set to **Both** and the Version set to **RIP-1**.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

8

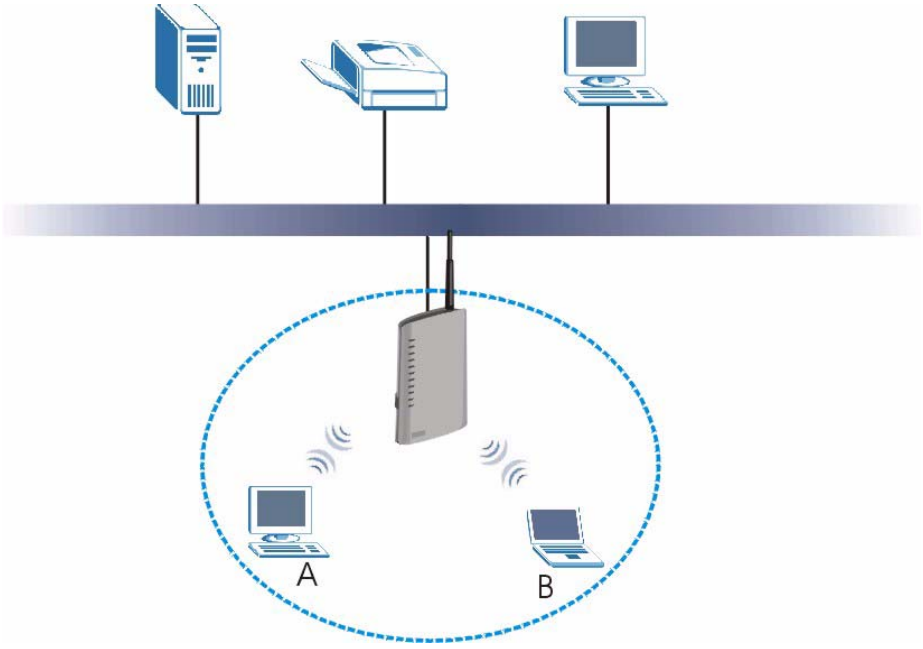
Wireless LAN

This chapter discusses how to configure the wireless network settings in your ZyXEL Device. See the appendices for more detailed information about wireless networks. This chapter applies to the "W" models only.

8.1 Wireless Network Overview

The following figure provides an example of a wireless network.

Figure 48 Example of a Wireless Network



The wireless network is the part in the blue circle. In this wireless network, devices **A** and **B** use the access point (AP) to interact with the other devices (such as the printer) or with the Internet. Your ZyXEL Device is the AP.

Every wireless network must follow these basic guidelines.

- Every device in the same wireless network must use the same SSID.
  The SSID is the name of the wireless network. It stands for Service Set IDentity.
- If two wireless networks overlap, they should use a different channel.

Like radio stations or television channels, each wireless network uses a specific channel, or frequency, to send and receive information.

- Every device in the same wireless network must use security compatible with the AP.

  Security stops unauthorized devices from using the wireless network. It can also protect the information that is sent in the wireless network.

8.2 Wireless Security Overview

The following sections introduce different types of wireless security you can set up in the wireless network.

8.2.1 SSID

Normally, the ZyXEL Device acts like a beacon and regularly broadcasts the SSID in the area. You can hide the SSID instead, in which case the ZyXEL Device does not broadcast the SSID. In addition, you should change the default SSID to something that is difficult to guess.

This type of security is fairly weak, however, because there are ways for unauthorized wireless devices to get the SSID. In addition, unauthorized wireless devices can still see the information that is sent in the wireless network.

8.2.2 MAC Address Filter

Every device that can use a wireless network has a unique identification number, called a MAC address.[1] A MAC address is usually written using twelve hexadecimal characters[2]; for example, 00A0C5000002 or 00:A0:C5:00:00:02. To get the MAC address for each device in the wireless network, see the device's User's Guide or other documentation.

You can use the MAC address filter to tell the ZyXEL Device which devices are allowed or not allowed to use the wireless network. If a device is allowed to use the wireless network, it still has to have the correct information (SSID, channel, and security). If a device is not allowed to use the wireless network, it does not matter if it has the correct information.

This type of security does not protect the information that is sent in the wireless network. Furthermore, there are ways for unauthorized wireless devices to get the MAC address of an authorized device. Then, they can use that MAC address to use the wireless network.

8.2.3 User Authentication

Authentication is the process of verifying whether a wireless device is allowed to use the wireless network. You can make every user log in to the wireless network before they can use it. However, every device in the wireless network has to support IEEE 802.1x to do this.

For wireless networks, you can store the user names and passwords for each user in a RADIUS server. This is a server used in businesses more than in homes. If you do not have a RADIUS server, you cannot set up user names and passwords for your users.

1. Some wireless devices, such as scanners, can detect wireless networks but cannot use wireless networks. These kinds of wireless devices might not have MAC addresses.
2. Hexadecimal characters are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F.

Unauthorized wireless devices can still see the information that is sent in the wireless network, even if they cannot use the wireless network. Furthermore, there are ways for unauthorized wireless users to get a valid user name and password. Then, they can use that user name and password to use the wireless network.

8.2.4 Encryption

Wireless networks can use encryption to protect the information that is sent in the wireless network. Encryption is like a secret code. If you do not know the secret code, you cannot understand the message.

The types of encryption you can choose depend on the type of authentication. (See Section 8.2.3 on page 102 for information about this.)

Table 28 Types of Encryption for Each Type of Authentication

	NO AUTHENTICATION	RADIUS SERVER
Weakest	No Security	WPA
↕	Static WEP	
	WPA-PSK	
Strongest	WPA2-PSK	WPA2

For example, if the wireless network has a RADIUS server, you can choose **WPA** or **WPA2**. If users do not log in to the wireless network, you can choose no encryption, **Static WEP**, **WPA-PSK**, or **WPA2-PSK**.

Usually, you should set up the strongest encryption that every device in the wireless network supports. For example, suppose you have a wireless network with the ZyXEL Device and you do not have a RADIUS server. Therefore, there is no authentication. Suppose the wireless network has two devices. Device A only supports WEP, and device B supports WEP and WPA. Therefore, you should set up **Static WEP** in the wireless network.

It is recommended that wireless networks use **WPA-PSK**, **WPA**, or stronger encryption. The other types of encryption are better than none at all, but it is still possible for unauthorized wireless devices to figure out the original information pretty quickly.

When you select **WPA2** or **WPA2-PSK** in your ZyXEL Device, you can also select an option (**WPA compatible**) to support WPA as well. In this case, if some of the devices support WPA and some support WPA2, you should set up **WPA2-PSK** or **WPA2** (depending on the type of wireless network login) and select the **WPA compatible** option in the ZyXEL Device.

Many types of encryption use a key to protect the information in the wireless network. The longer the key, the stronger the encryption. Every device in the wireless network must have the same key.

8.2.5 One-Touch Intelligent Security Technology (OTIST)

With ZyXEL's OTIST, you set up the SSID and the encryption (WEP or WPA-PSK) on the ZyXEL Device. Then, the ZyXEL Device transfers them to the devices in the wireless networks. As a result, you do not have to set up the SSID and encryption on every device in the wireless network.

The devices in the wireless network have to support OTIST, and they have to be in range of the ZyXEL Device when you activate it. See Section 8.5 on page 111 for more details.

8.3 Additional Wireless Terms

The following table describes wireless network terms and acronyms used in the ZyXEL Device's Web Configurator.

Table 29 Additional Wireless Terms

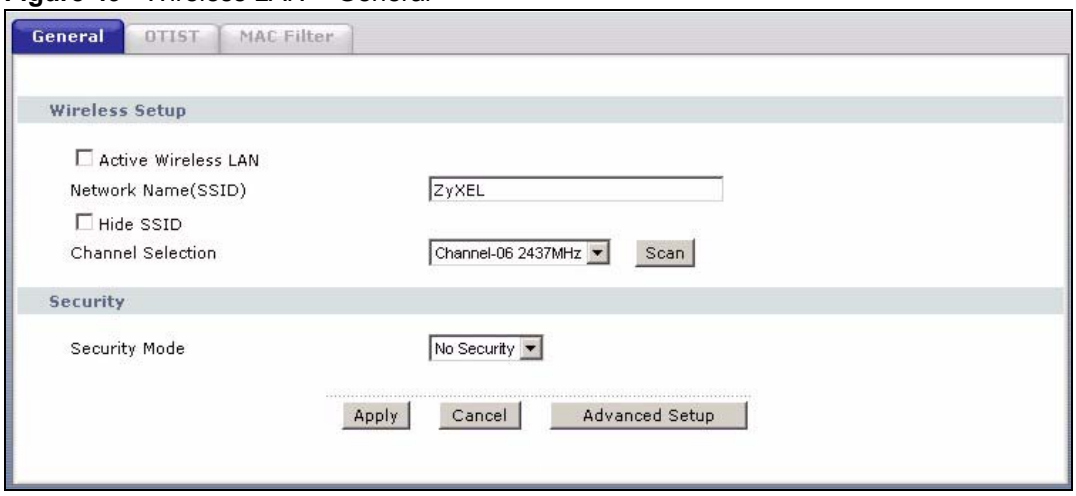
TERM	DESCRIPTION
RTS/CTS Threshold	In a wireless network which covers a large area, wireless devices are sometimes not aware of each other's presence. This may cause them to send information to the AP at the same time and result in information colliding and not getting through. By setting this value lower than the default value, the wireless devices must sometimes get permission to send information to the ZyXEL Device. The lower the value, the more often the devices must get permission. If this value is greater than the fragmentation threshold value (see below), then wireless devices never have to get permission to send information to the ZyXEL Device.
Preamble	A preamble affects the timing in your wireless network. There are two preamble modes: long and short. If a device uses a different preamble mode than the ZyXEL Device does, it cannot communicate with the ZyXEL Device.
Authentication	The process of verifying whether a wireless device is allowed to use the wireless network.
Fragmentation Threshold	A small fragmentation threshold is recommended for busy networks, while a larger threshold provides faster performance if the network is not very busy.

8.4 General WLAN Screen

If you are configuring the ZyXEL Device from a computer connected to the wireless LAN and you change the ZyXEL Device's SSID or security settings, you will lose your wireless connection when you press **Apply** to confirm. You must then change the wireless settings of your computer to match the ZyXEL Device's new settings.

Click **Network > Wireless LAN** to open the **Wireless LAN General** screen.

Figure 49 Wireless LAN > General



The following table describes the labels in this screen.

Table 30 Wireless LAN > General

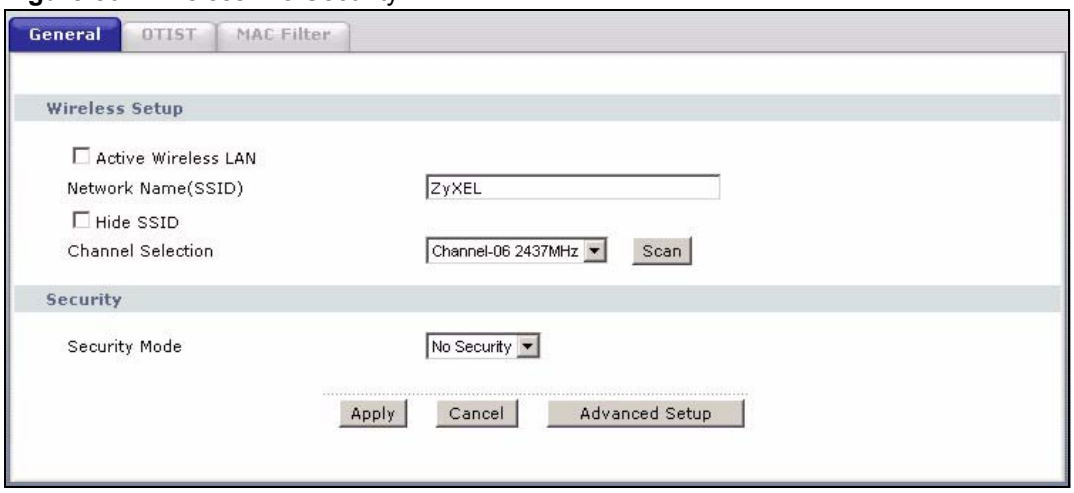
LABEL	DESCRIPTION
Active Wireless LAN	Click the check box to activate wireless LAN.
Network Name (SSID)	(Service Set IDentity) The SSID identifies the Service Set with which a wireless station is associated. Wireless stations associating to the access point (AP) must have the same SSID. Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN. Note: If you are configuring the ZyXEL Device from a computer connected to the wireless LAN and you change the ZyXEL Device's SSID or WEP settings, you will lose your wireless connection when you press Apply to confirm. You must then change the wireless settings of your computer to match the ZyXEL Device's new settings.
Hide SSID	Select this check box to hide the SSID in the outgoing beacon frame so a station cannot obtain the SSID through scanning using a site survey tool.
Channel Selection	Set the operating frequency/channel depending on your particular region. Select a channel from the drop-down list box.
Scan	Click this button to have the ZyXEL Device automatically scan for and select a channel which is not used by another device.
Security Mode	See the following sections for more details about this field.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to reload the previous configuration for this screen.
Advanced Setup	Click **Advanced Setup** to display the **Wireless Advanced Setup** screen and edit more details of your WLAN setup.

8.4.1 No Security

Select **No Security** to allow wireless stations to communicate with the access points without any data encryption.

If you do not enable any wireless security on your ZyXEL Device, your network is accessible to any wireless networking device that is within range.

Figure 50 Wireless: No Security



The following table describes the labels in this screen.

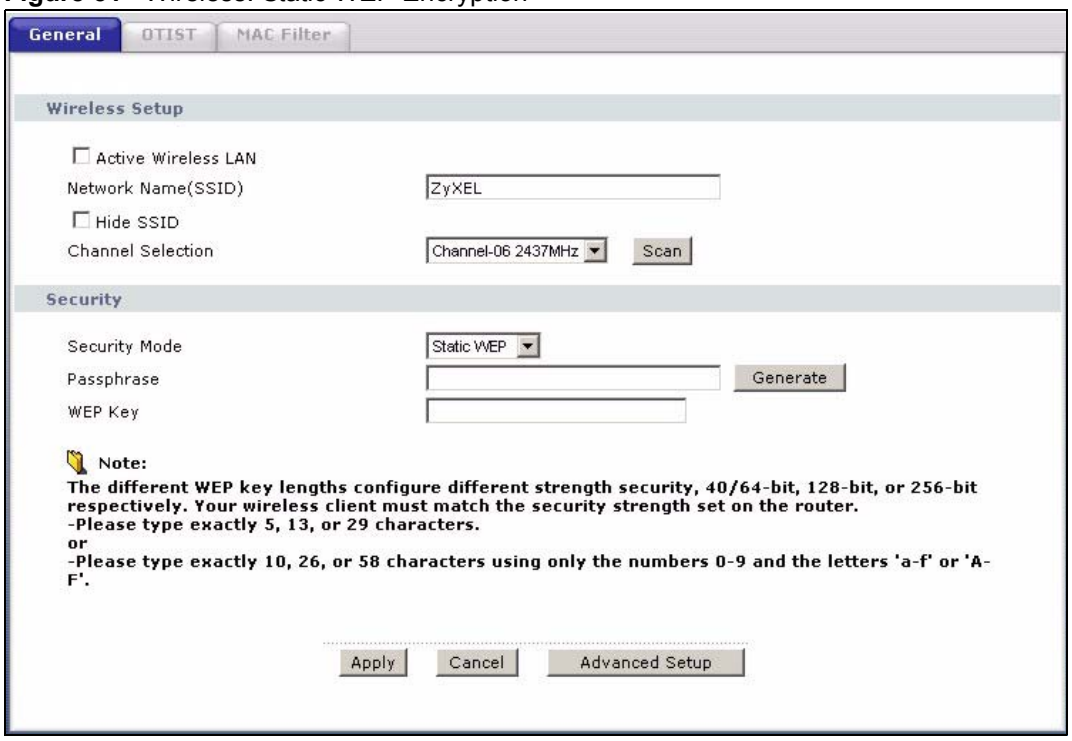
Table 31 Wireless No Security

LABEL	DESCRIPTION
Security Mode	Choose **No Security** from the drop-down list box.

8.4.2 WEP Encryption Screen

In order to configure and enable WEP encryption; click **Network > Wireless LAN** to display the **General** screen. Select **Static WEP** from the **Security** Mode list.

Figure 51 Wireless: Static WEP Encryption



The following table describes the wireless LAN security labels in this screen.

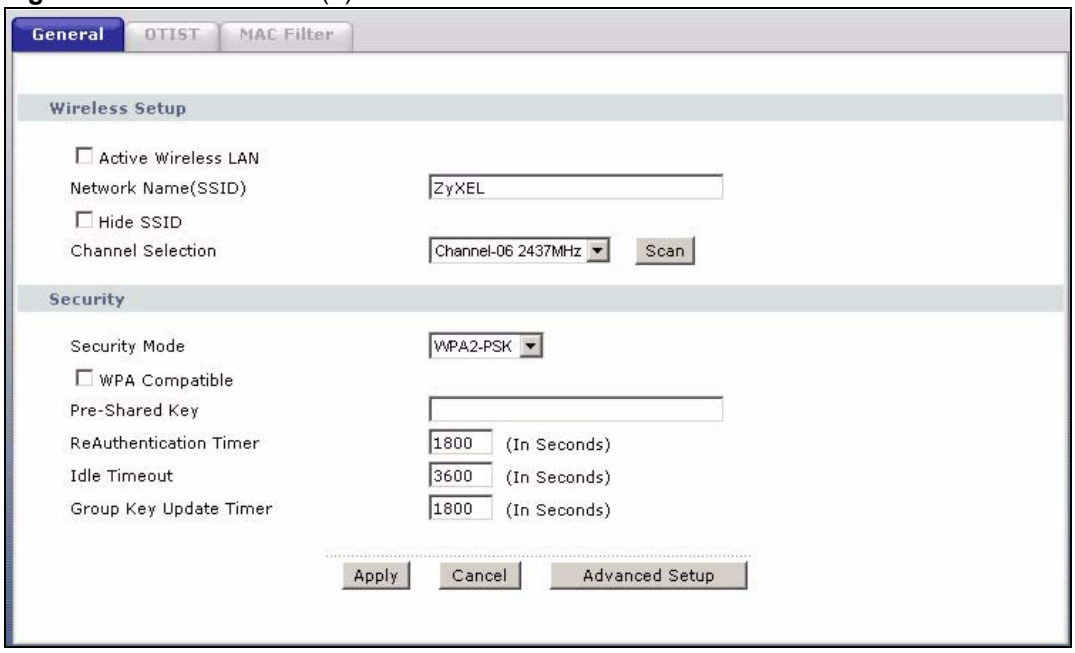
Table 32 Wireless: Static WEP Encryption

LABEL	DESCRIPTION
Security Mode	Choose **Static WEP** from the drop-down list box.
Passphrase	Enter a Passphrase (up to 32 printable characters) and click **Generate**. The ZyXEL Device automatically generates a WEP key.
WEP Key	The WEP key is used to encrypt data. Both the ZyXEL Device and the wireless stations must use the same WEP key for data transmission. If you want to manually set the WEP key, enter any 5, 13 or 29 characters (ASCII string) or 10, 26 or 58 hexadecimal characters ("0-9", "A-F") for a 64-bit, 128-bit or 256-bit WEP key respectively.

8.4.3 WPA(2)-PSK

In order to configure and enable WPA(2)-PSK authentication; click **Network > Wireless LAN** to display the **General** screen. Select **WPA-PSK** or **WPA2-PSK** from the **Security Mode** list.

Figure 52 Wireless: WPA(2)-PSK



The following table describes the wireless LAN security labels in this screen.

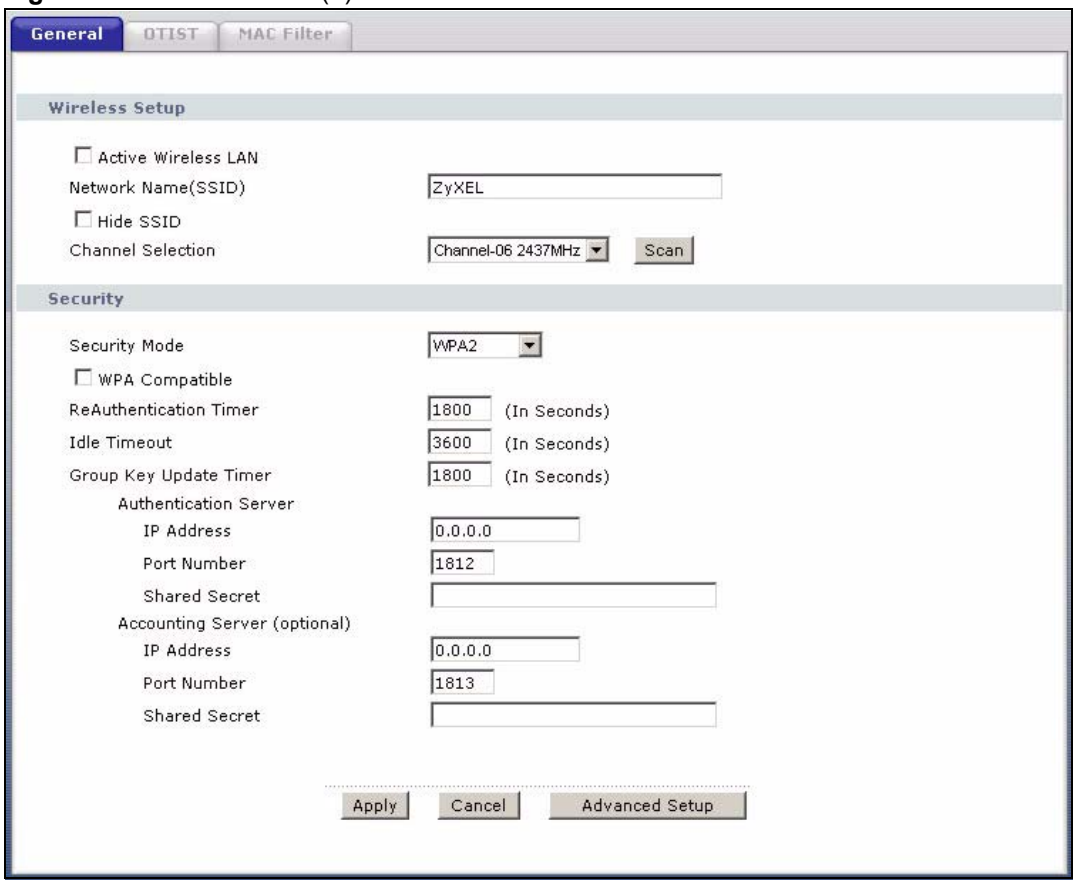
Table 33 Wireless: WPA(2)-PSK

LABEL	DESCRIPTION
Security Mode	Choose **WPA-PSK** or **WPA2-PSK** from the drop-down list box.
WPA Compatible	This field is only available for WPA2-PSK. Select this if you want the ZyXEL Device to support WPA-PSK and WPA2-PSK simultaneously.
Pre-Shared Key	The encryption mechanisms used for **WPA(2)** and **WPA(2)-PSK** are the same. The only difference between the two is that **WPA(2)-PSK** uses a simple common password, instead of user-specific credentials. Type a pre-shared key from 8 to 63 case-sensitive ASCII characters (including spaces and symbols).
ReAuthentication Timer (in seconds)	Specify how often wireless stations have to resend usernames and passwords in order to stay connected. Enter a time interval between 10 and 9999 seconds. The default time interval is 1800 seconds (30 minutes). Note: If wireless station authentication is done using a RADIUS server, the reauthentication timer on the RADIUS server has priority.
Idle Timeout	The ZyXEL Device automatically disconnects a wireless station from the wired network after a period of inactivity. The wireless station needs to enter the username and password again before access to the wired network is allowed. The default time interval is 3600 seconds (or 1 hour).
Group Key Update Timer	The **Group Key Update Timer** is the rate at which the AP (if using **WPA(2)-PSK** key management) or **RADIUS** server (if using WPA(2) key management) sends a new group key out to all clients. The re-keying process is the WPA(2) equivalent of automatically changing the WEP key for an AP and all stations in a WLAN on a periodic basis. Setting of the **Group Key Update Timer** is also supported in **WPA(2)-PSK** mode. The ZyXEL Device default is **1800** seconds (30 minutes).

8.4.4 WPA(2) Authentication Screen

In order to configure and enable WPA Authentication; click the **Wireless LAN** link under **Network** to display the **Wireless** screen. Select **WPA** or **WPA2** from the **Security** list.

Figure 53 Wireless: WPA(2)



The following table describes the wireless LAN security labels in this screen.

Table 34 Wireless: WPA(2)

LABEL	DESCRIPTION
Security Mode	Choose **WPA** or **WPA2** from the drop-down list box.
WPA Compatible	This field is only available for WPA2. Select this if you want the ZyXEL Device to support WPA and WPA2 simultaneously.
ReAuthentication Timer (in seconds)	Specify how often wireless stations have to resend usernames and passwords in order to stay connected. Enter a time interval between 10 and 9999 seconds. The default time interval is 1800 seconds (30 minutes). Note: If wireless station authentication is done using a RADIUS server, the reauthentication timer on the RADIUS server has priority.
Idle Timeout	The ZyXEL Device automatically disconnects a wireless station from the wired network after a period of inactivity. The wireless station needs to enter the username and password again before access to the wired network is allowed. The default time interval is 3600 seconds (or 1 hour).

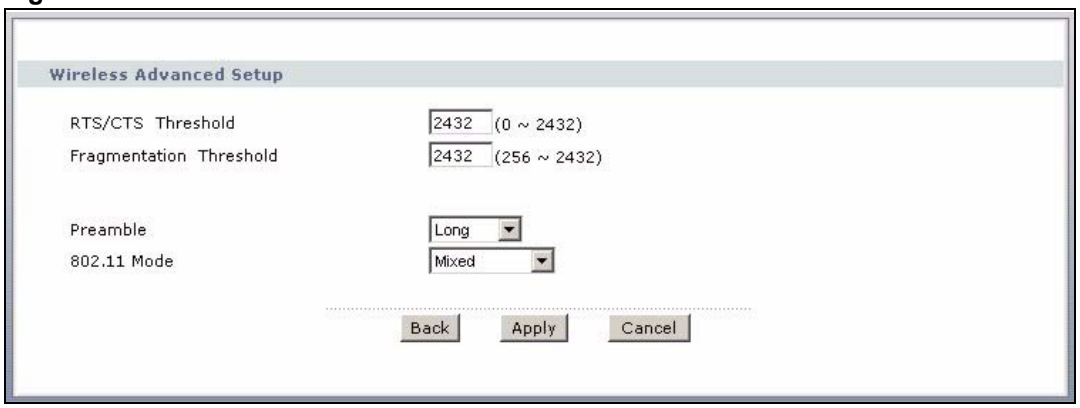
Table 34 Wireless: WPA(2)

LABEL	DESCRIPTION
Group Key Update Timer	The **Group Key Update Timer** is the rate at which the AP (if using **WPA(2)-PSK** key management) or **RADIUS** server (if using WPA(2) key management) sends a new group key out to all clients. The re-keying process is the WPA(2)equivalent of automatically changing the WEP key for an AP and all stations in a WLAN on a periodic basis. Setting of the **Group Key Update Timer** is also supported in **WPA(2)-PSK** mode. The ZyXEL Device default is **1800** seconds (30 minutes).
Authentication Server	
IP Address	Enter the IP address of the external authentication server in dotted decimal notation.
Port Number	Enter the port number of the external authentication server. The default port number is **1812**. You need not change this value unless your network administrator instructs you to do so with additional information.
Shared Secret	Enter a password (up to 31 alphanumeric characters) as the key to be shared between the external authentication server and the ZyXEL Device. The key must be the same on the external authentication server and your ZyXEL Device. The key is not sent over the network.
Accounting Server (optional)	
IP Address	Enter the IP address of the external accounting server in dotted decimal notation.
Port Number	Enter the port number of the external accounting server. The default port number is **1813**. You need not change this value unless your network administrator instructs you to do so with additional information.
Shared Secret	Enter a password (up to 31 alphanumeric characters) as the key to be shared between the external accounting server and the ZyXEL Device. The key must be the same on the external accounting server and your ZyXEL Device. The key is not sent over the network.

8.4.5 Wireless LAN Advanced Setup

To configure advanced wireless settings, click the **Advanced Setup** button in the **General** screen. The screen appears as shown.

Figure 54 Wireless LAN: Advanced



The following table describes the labels in this screen.

Table 35 Wireless LAN: Advanced

LABEL	DESCRIPTION
Wireless Advanced Setup	
RTS/CTS Threshold	Enter a value between 0 and 2432.
Fragmentation Threshold	It is the maximum data fragment size that can be sent. Enter a value between 256 and 2432.
Preamble	Select a preamble type from the drop-down list menu. Choices are **Long**, **Short** or **Dynamic**. The default setting is **Long**. See the appendix for more information.
802.11 Mode	Select **802.11b Only** to allow only IEEE 802.11b compliant WLAN devices to associate with the ZyXEL Device. Select **802.11g Only** to allow only IEEE 802.11g compliant WLAN devices to associate with the ZyXEL Device. Select **Mixed** to allow either IEEE 802.11b or IEEE 802.11g compliant WLAN devices to associate with the ZyXEL Device. The transmission rate of your ZyXEL Device might be reduced.
Back	Click this to return to the previous screen without saving changes.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

8.5 OTIST Screen

Use this screen to set up and start OTIST on the ZyXEL Device in your wireless network. To open this screen, click **Network > Wireless LAN > OTIST**.

Figure 55 Network > Wireless LAN > OTIST

General
OTIST
MAC Filter
OTIST
Setup Key
Yes! Please enhance the Wireless Security Level to WPA-PSK automatically if no WLAN security has been set.
This will generate a random PSK key for your convenience.
Start

The following table describes the labels in this screen.

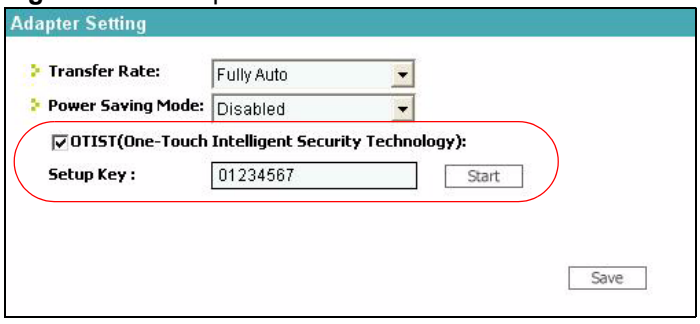
Table 36 Network > Wireless LAN > OTIST

LABEL	DESCRIPTION
Setup Key	Type a key (password) 8 ASCII characters long. Note: If you change the OTIST setup key in the ZyXEL Device, you must change it on the wireless devices too.
Yes!	Select this if you want the ZyXEL Device to automatically generate a pre-shared key for the wireless network. Before you do this, click **Network > Wireless LAN > General** and set the **Security Mode** to **No Security**. Clear this if you want the ZyXEL Device to use a pre-shared key that you enter. Before you do this, click **Network > Wireless LAN > General**, set the **Security Mode** to **WPA-PSK**, and enter the **Pre-Shared Key**.
Start	Click **Start** to activate OTIST and transfer settings. The process takes three minutes to complete. Note: You must click **Start** in the ZyXEL Device and in the wireless device(s) within three minutes of each other. You can start OTIST in the wireless devices and the ZyXEL Device in any order.

Before you click **Start**, you should enable OTIST on all the OTIST-enabled devices in the wireless network. For most devices, follow these steps.

1. Start the ZyXEL utility
2. Click the **Adapter** tab.
3. Select the **OTIST** check box, and enter the same **Setup Key** as the ZyXEL Device.
4. Click **Save**.

Figure 56 Example: Wireless Client OTIST Screen

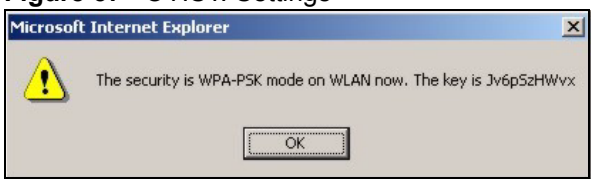


To start OTIST in the device, click **Start** in this screen.

You must click **Start** in the ZyXEL Device and in the wireless device(s) within three minutes of each other. You can start OTIST in the wireless devices and the ZyXEL Device in any order.

After you click **Start** in the ZyXEL Device, the following screen appears (in the ZyXEL Device).

Figure 57 OTIST: Settings



You can use the key in this screen to set up WPA-PSK encryption manually for non-OTIST devices in the wireless network.

Review the settings, and click **OK**. The ZyXEL Device begins transferring OTIST settings. The following screens appear in the ZyXEL Device and in the wireless devices.

Figure 58 OTIST: In Progress on the ZyXEL Device

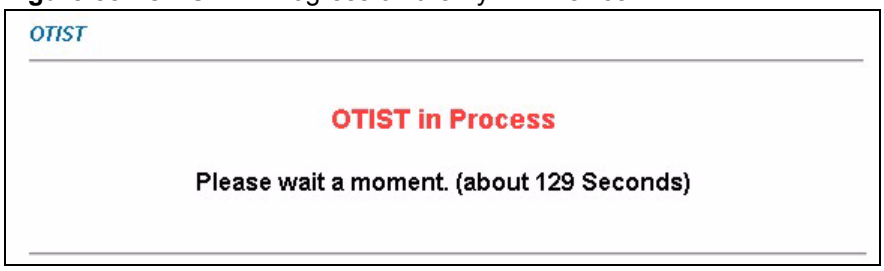
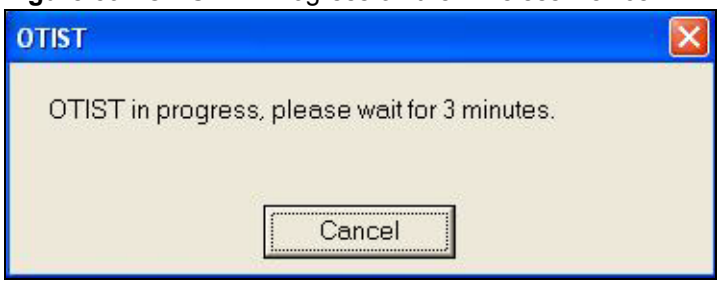


Figure 59 OTIST: In Progress on the Wireless Device



These screens close when the transfer is complete.

8.5.1 Notes on OTIST

1 If you enable OTIST in a wireless device, you see this screen each time you start the utility. Click **Yes** to search for an OTIST-enabled AP (in other words, the ZyXEL Device).

Figure 60 Start OTIST?

2 If an OTIST-enabled wireless device loses its wireless connection for more than ten seconds, it will search for an OTIST-enabled AP for up to one minute. (If you manually have the wireless device search for an OTIST-enabled AP, there is no timeout; click **Cancel** in the OTIST progress screen to stop the search.)

3 After the wireless device finds an OTIST-enabled AP, you must click **Start** in the ZyXEL Device's **Network > Wireless LAN > OTIST** screen or hold in the **RESET** button on the ZyXEL Device for three seconds to transfer the settings again.

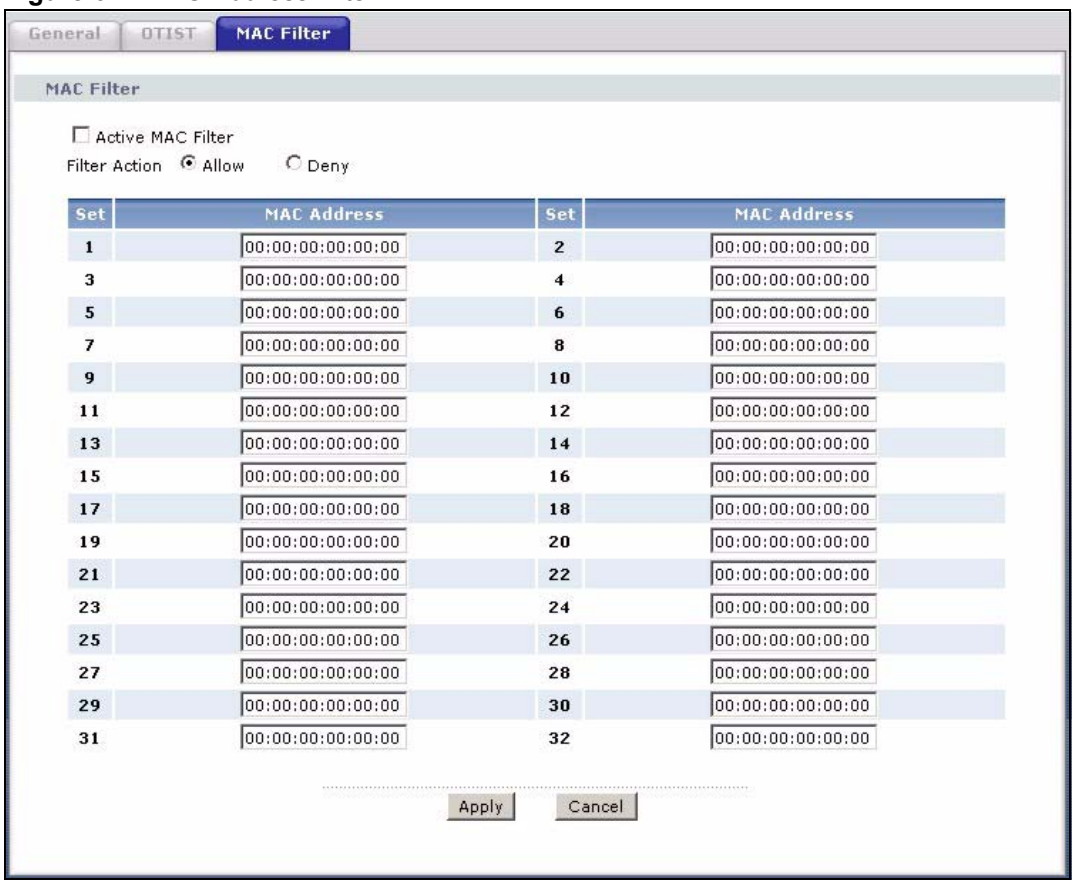
4 If you change the SSID or the keys on the ZyXEL Devices after using OTIST, you need to run OTIST again or enter them manually in the wireless device(s).

5 If you configure OTIST to generate a WPA-PSK key, this key changes each time you run OTIST. Therefore, if a new wireless device joins your wireless network, you need to run OTIST on the AP and ALL wireless devices again.

8.6 MAC Filter

Use this screen to change your ZyXEL Device's MAC filter settings. Click **Network > Wireless LAN** > **MAC Filter**. The screen appears as shown.

Figure 61 MAC Address Filter



The following table describes the labels in this screen.

Table 37 MAC Address Filter

LABEL	DESCRIPTION
Active MAC Filter	Select the check box to enable MAC address filtering.
Filter Action	Define the filter action for the list of MAC addresses in the **MAC Address** table. Select **Deny** to block access to the ZyXEL Device, MAC addresses not listed will be allowed to access the ZyXEL Device Select **Allow** to permit access to the ZyXEL Device, MAC addresses not listed will be denied access to the ZyXEL Device.
Set	This is the index number of the MAC address.
MAC Address	Enter the MAC addresses of the wireless station that are allowed or denied access to the ZyXEL Device in these address fields. Enter the MAC addresses in a valid MAC address format, that is, six hexadecimal character pairs, for example, 12:34:56:78:9a:bc.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

9

Network Address Translation (NAT) Screens

This chapter discusses how to configure NAT on the ZyXEL Device.

9.1 NAT General Overview

NAT (Network Address Translation - NAT, RFC 1631) is the translation of the IP address of a host in a packet, for example, the source address of an outgoing packet, used within one network to a different IP address known within another network.

9.1.1 NAT Definitions

Inside/outside denotes where a host is located relative to the ZyXEL Device, for example, the computers of your subscribers are the inside hosts, while the web servers on the Internet are the outside hosts.

Global/local denotes the IP address of a host in a packet as the packet traverses a router, for example, the local address refers to the IP address of a host when the packet is in the local network, while the global address refers to the IP address of the host when the same packet is traveling in the WAN side.

Note that inside/outside refers to the location of a host, while global/local refers to the IP address of a host used in a packet. Thus, an inside local address (ILA) is the IP address of an inside host in a packet when the packet is still in the local network, while an inside global address (IGA) is the IP address of the same inside host when the packet is on the WAN side. The following table summarizes this information.

Table 38 NAT Definitions

ITEM	DESCRIPTION
Inside	This refers to the host on the LAN.
Outside	This refers to the host on the WAN.
Local	This refers to the packet address (source or destination) as the packet travels on the LAN.
Global	This refers to the packet address (source or destination) as the packet travels on the WAN.

NAT never changes the IP address (either local or global) of an outside host.

9.1.2 What NAT Does

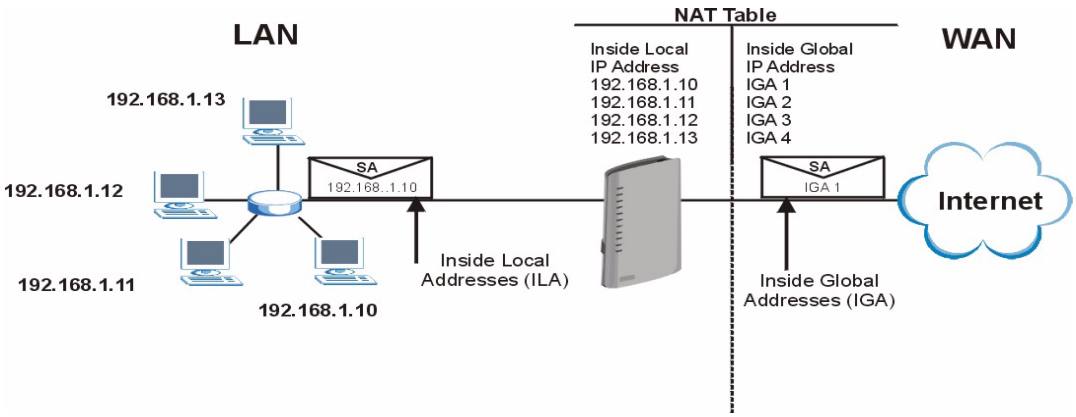
In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address) back to the inside local address before forwarding it to the original inside host. Note that the IP address (either local or global) of an outside host is never changed.

The global IP addresses for the inside hosts can be either static or dynamically assigned by the ISP. In addition, you can designate servers, for example, a web server and a telnet server, on your local network and make them accessible to the outside world. If you do not define any servers (for Many-to-One and Many-to-Many Overload mapping – see Table 39 on page 120), NAT offers the additional benefit of firewall protection. With no servers defined, your ZyXEL Device filters out all incoming inquiries, thus preventing intruders from probing your network. For more information on IP address translation, refer to *RFC 1631*, *The IP Network Address Translator (NAT)*.

9.1.3 How NAT Works

Each packet has two addresses – a source address and a destination address. For outgoing packets, the ILA (Inside Local Address) is the source address on the LAN, and the IGA (Inside Global Address) is the source address on the WAN. For incoming packets, the ILA is the destination address on the LAN, and the IGA is the destination address on the WAN. NAT maps private (local) IP addresses to globally unique ones required for communication with hosts on other networks. It replaces the original IP source address (and TCP or UDP source port numbers for Many-to-One and Many-to-Many Overload NAT mapping) in each packet and then forwards it to the Internet. The ZyXEL Device keeps track of the original addresses and port numbers so incoming reply packets can have their original values restored. The following figure illustrates this.

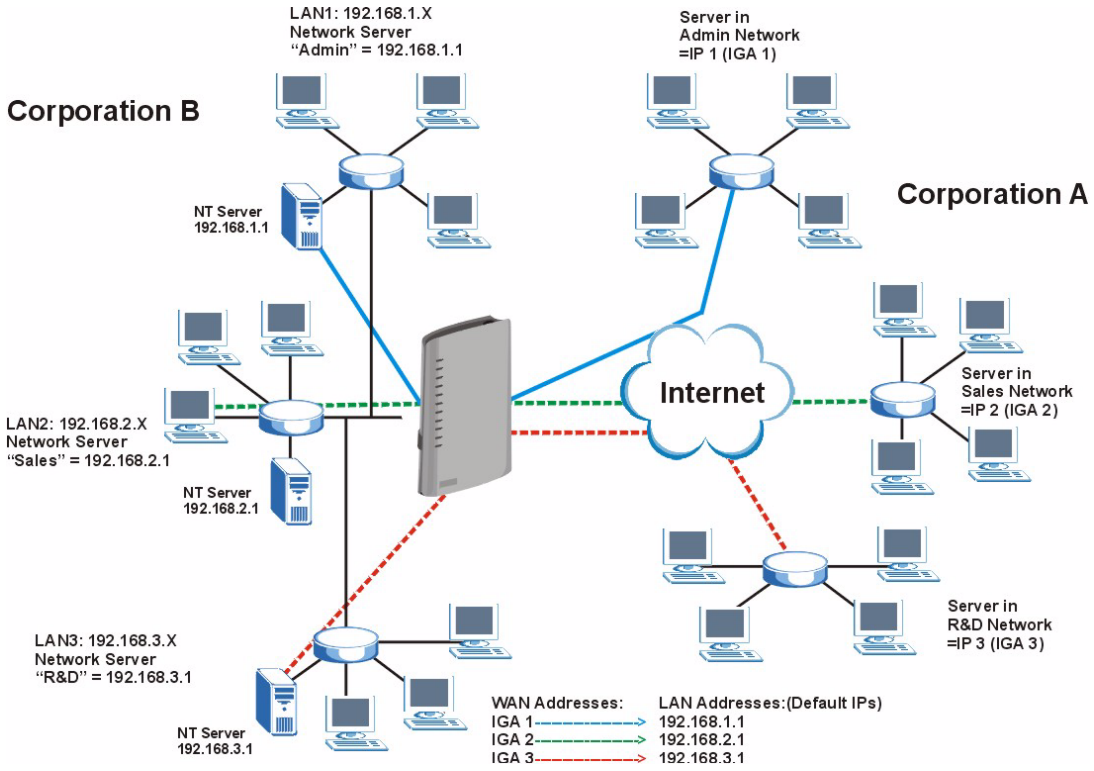
Figure 62 How NAT Works



9.1.4 NAT Application

The following figure illustrates a possible NAT application, where three inside LANs (logical LANs using IP Alias) behind the ZyXEL Device can communicate with three distinct WAN networks.

Figure 63 NAT Application With IP Alias



9.1.5 NAT Mapping Types

NAT supports five types of IP/port mapping. They are:

- **One to One**: In One-to-One mode, the ZyXEL Device maps one local IP address to one global IP address.
- **Many to One**: In Many-to-One mode, the ZyXEL Device maps multiple local IP addresses to one global IP address. This is equivalent to SUA (for instance, PAT, port address translation), ZyXEL's Single User Account feature that previous ZyXEL routers supported (the **SUA Only** option in today's routers).
- **Many to Many Overload**: In Many-to-Many Overload mode, the ZyXEL Device maps the multiple local IP addresses to shared global IP addresses.
- **Many-to-Many No Overload**: In Many-to-Many No Overload mode, the ZyXEL Device maps each local IP address to a unique global IP address.
- **Server**: This type allows you to specify inside servers of different services behind the NAT to be accessible to the outside world.

Port numbers do NOT change for **One-to-One** and **Many-to-Many No Overload** NAT mapping types.

The following table summarizes these types.

Table 39 NAT Mapping Types

TYPE	IP MAPPING
One-to-One	ILA1←→ IGA1
Many-to-One (SUA/PAT)	ILA1←→ IGA1 ILA2←→ IGA1 …
Many-to-Many Overload	ILA1←→ IGA1 ILA2←→ IGA2 ILA3←→ IGA1 ILA4←→ IGA2 …
Many-to-Many No Overload	ILA1←→ IGA1 ILA2←→ IGA2 ILA3←→ IGA3 …
Server	Server 1 IP←→ IGA1 Server 2 IP←→ IGA1 Server 3 IP←→ IGA1

9.2 SUA (Single User Account) Versus NAT

SUA (Single User Account) is a ZyNOS implementation of a subset of NAT that supports two types of mapping, **Many-to-One** and **Server**. The ZyXEL Device also supports **Full Feature** NAT to map multiple global IP addresses to multiple private LAN IP addresses of clients or servers using mapping types as outlined in Table 39 on page 120.

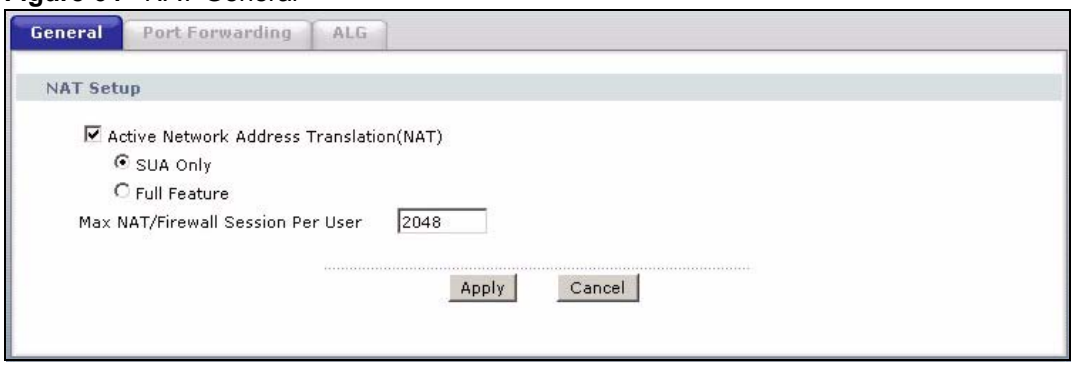
- Choose **SUA Only** if you have just one public WAN IP address for your ZyXEL Device.
- Choose **Full Feature** if you have multiple public WAN IP addresses for your ZyXEL Device.

9.3 NAT General Setup

You must create a firewall rule in addition to setting up SUA/NAT, to allow traffic from the WAN to be forwarded through the ZyXEL Device.

Click **Network > NAT** to open the following screen.

Figure 64 NAT General



The following table describes the labels in this screen.

Table 40 NAT General

LABEL	DESCRIPTION
Active Network Address Translation (NAT)	Select this check box to enable NAT.
SUA Only	Select this radio button if you have just one public WAN IP address for your ZyXEL Device.
Full Feature	Select this radio button if you have multiple public WAN IP addresses for your ZyXEL Device.
Max NAT/ Firewall Session Per User	When computers use peer to peer applications, such as file sharing applications, they need to establish NAT sessions. If you do not limit the number of NAT sessions a single client can establish, this can result in all of the available NAT sessions being used. In this case, no additional NAT sessions can be established, and users may not be able to access the Internet. Each NAT session establishes a corresponding firewall session. Use this field to limit the number of NAT/Firewall sessions client computers can establish through the ZyXEL Device. If your network has a small number of clients using peer to peer applications, you can raise this number to ensure that their performance is not degraded by the number of NAT sessions they can establish. If your network has a large number of users using peer to peer applications, you can lower this number to ensure no single client is exhausting all of the available NAT sessions.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to reload the previous configuration for this screen.

9.4 Port Forwarding

A port forwarding set is a list of inside (behind NAT on the LAN) servers, for example, web or FTP, that you can make visible to the outside world even though NAT makes your whole inside network appear as a single computer to the outside world.

You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 and FTP on port 21. In some cases, such as for unknown services or where one server can support more than one service (for example both FTP and web service), it might be better to specify a range of port numbers. You can allocate a server IP address that corresponds to a port or a range of ports.

Many residential broadband ISP accounts do not allow you to run any server processes (such as a Web or FTP server) from your location. Your ISP may periodically check for servers and may suspend your account if it discovers any active services at your location. If you are unsure, refer to your ISP.

9.4.1 Default Server IP Address

In addition to the servers for specified services, NAT supports a default server IP address. A default server receives packets from ports that are not specified in this screen.

If you do not assign a **Default Server** IP address, the ZyXEL Device discards all packets received for ports that are not specified here or in the remote management setup.

9.4.2 Port Forwarding: Services and Port Numbers

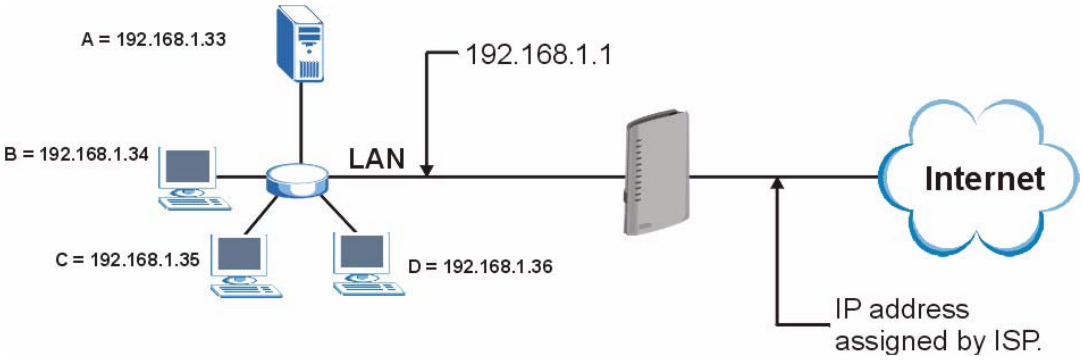
Use the **Port Forwarding** screen to forward incoming service requests to the server(s) on your local network.

The most often used port numbers and services are shown in Appendix E on page 373. Please refer to RFC 1700 for further information about port numbers.

9.4.3 Configuring Servers Behind Port Forwarding (Example)

Let's say you want to assign ports 21-25 to one FTP, Telnet and SMTP server (**A** in the example), port 80 to another (**B** in the example) and assign a default server IP address of 192.168.1.35 to a third (**C** in the example). You assign the LAN IP addresses and the ISP assigns the WAN IP address. The NAT network appears as a single host on the Internet.

Figure 65 Multiple Servers Behind NAT Example



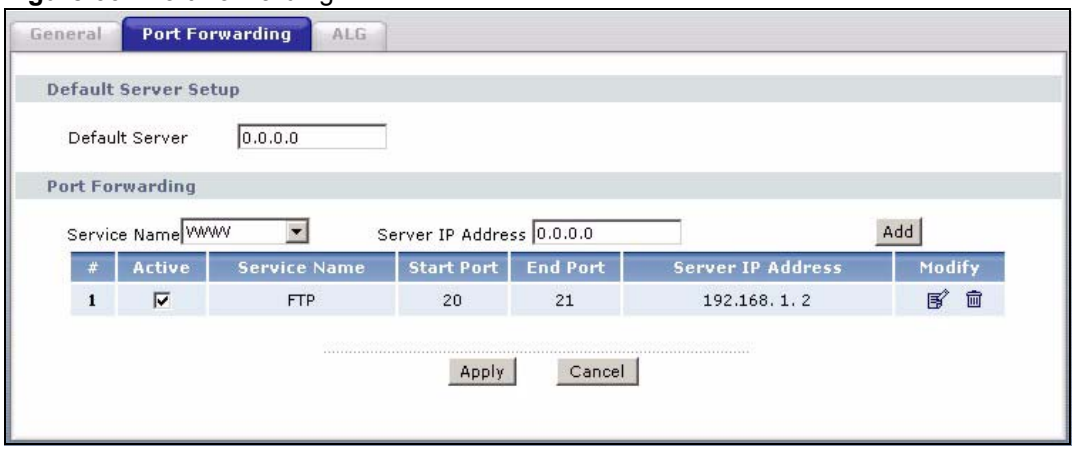
9.5 Configuring Port Forwarding

If you do not assign a **Default Server** IP address, the ZyXEL Device discards all packets received for ports that are not specified here or in the remote management setup.

Click **Network > NAT > Port Forwarding** to open the following screen. This screen is available only when you select **SUA only** in the **NAT > General** screen.

See Appendix E on page 373 for port numbers commonly used for particular services.

Figure 66 Port Forwarding



The following table describes the fields in this screen.

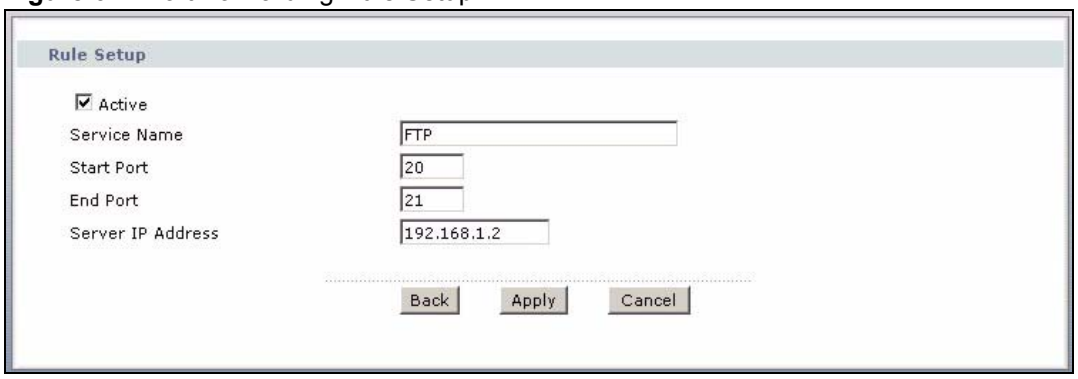
Table 41 Port Forwarding

LABEL	DESCRIPTION
Default Server Setup	
Default Server	In addition to the servers for specified services, NAT supports a default server. A default server receives packets from ports that are not specified in this screen. If you do not assign a **Default Server** IP address, the ZyXEL Device discards all packets received for ports that are not specified here or in the remote management setup.
Port Forwarding	
Service Name	Select a service from the drop-down list box.
Server IP Address	Enter the IP address of the server for the specified service.
Add	Click this button to add a rule to the table below.
#	This is the rule index number (read-only).
Active	This field indicates whether the rule is active or not. Clear the check box to disable the rule. Select the check box to enable it.
Service Name	This is a service's name.
Start Port	This is the first port number that identifies a service.
End Port	This is the last port number that identifies a service.
Server IP Address	This is the server's IP address.
Modify	Click the edit icon to go to the screen where you can edit the port forwarding rule. Click the delete icon to delete an existing port forwarding rule. Note that subsequent address mapping rules move up by one when you take this action.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to return to the previous configuration.

9.5.1 Port Forwarding Rule Edit

Use this screen to edit a port forwarding rule. Click the rule's edit icon in the **Port Forwarding** screen to display the screen shown next.

Figure 67 Port Forwarding Rule Setup



The following table describes the fields in this screen.

Table 42 Port Forwarding Rule Setup

LABEL	DESCRIPTION
Active	Click this check box to enable the rule.
Service Name	Enter a name to identify this port-forwarding rule.
Start Port	Enter a port number in this field. To forward only one port, enter the port number again in the **End Port** field. To forward a series of ports, enter the start port number here and the end port number in the **End Port** field.
End Port	Enter a port number in this field. To forward only one port, enter the port number again in the **Start Port** field above and then enter it again in this field. To forward a series of ports, enter the last port number in a series that begins with the port number in the **Start Port** field above.
Server IP Address	Enter the inside IP address of the server here.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

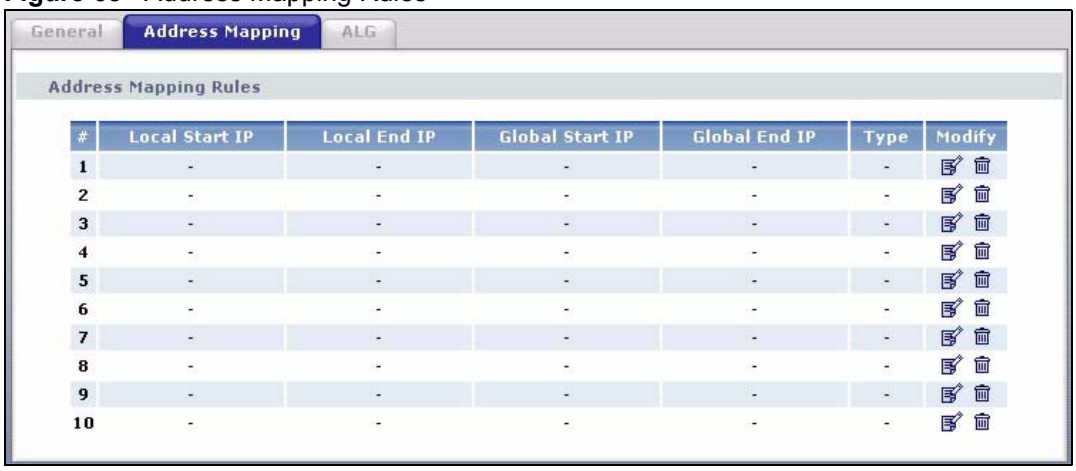
9.6 Address Mapping

The **Address Mapping** screen is available only when you select **Full Feature** in the **NAT > General** screen.

Ordering your rules is important because the ZyXEL Device applies the rules in the order that you specify. When a rule matches the current packet, the ZyXEL Device takes the corresponding action and the remaining rules are ignored.

To change your ZyXEL Device's address mapping settings, click **Network > NAT > Address Mapping** to open the following screen.

Figure 68 Address Mapping Rules


General
Address Mapping
ALG
Address Mapping Rules
Local Start IP Local End IP Global Start IP Global End IP Type Modify
1 - - - - -
2 - - - - -
3 - - - - -
4 - - - - -
5 - - - - -
6 - - - - -
7 - - - - -
8 - - - - -
9 - - - - -
10 - - - - -

The following table describes the fields in this screen.

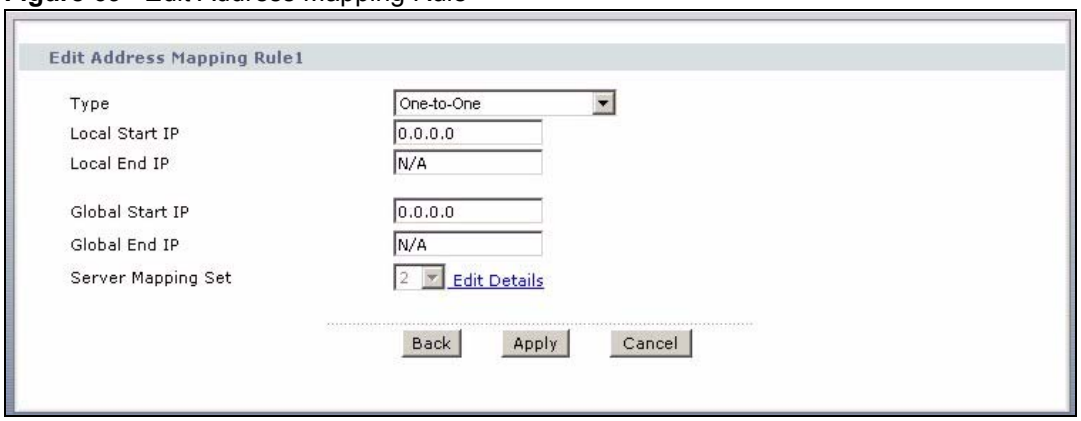
Table 43 Address Mapping Rules

LABEL	DESCRIPTION
#	This is the rule index number.
Local Start IP	This is the starting Inside Local IP Address (ILA). Local IP addresses are **N/A** for **Server** port mapping.
Local End IP	This is the end Inside Local IP Address (ILA). If the rule is for all local IP addresses, then this field displays 0.0.0.0 as the **Local Start IP** address and 255.255.255.255 as the **Local End IP** address. This field is **N/A** for **One-to-one** and **Server** mapping types.
Global Start IP	This is the starting Inside Global IP Address (IGA). Enter 0.0.0.0 here if you have a dynamic IP address from your ISP. You can only do this for **Many-to-One** and **Server** mapping types.
Global End IP	This is the ending Inside Global IP Address (IGA). This field is **N/A** for **One-to-one**, **Many-to-One** and **Server** mapping types.
Type	**1-1**: One-to-one mode maps one local IP address to one global IP address. Note that port numbers do not change for the One-to-one NAT mapping type. **M-1**: Many-to-One mode maps multiple local IP addresses to one global IP address. This is equivalent to SUA (i.e., PAT, port address translation), ZyXEL's Single User Account feature that previous ZyXEL routers supported only. **M-M Ov** (Overload): Many-to-Many Overload mode maps multiple local IP addresses to shared global IP addresses. **M-M No** (No Overload): Many-to-Many No Overload mode maps each local IP address to unique global IP addresses. **Server**: This type allows you to specify inside servers of different services behind the NAT to be accessible to the outside world.
Modify	Click the edit icon to go to the screen where you can edit the address mapping rule. Click the delete icon to delete an existing address mapping rule. Note that subsequent address mapping rules move up by one when you take this action.

9.6.1 Address Mapping Rule Edit

To edit an address mapping rule, click the rule's edit icon in the **Address Mapping** screen to display the screen shown next.

Figure 69 Edit Address Mapping Rule



The following table describes the fields in this screen.

Table 44 Edit Address Mapping Rule

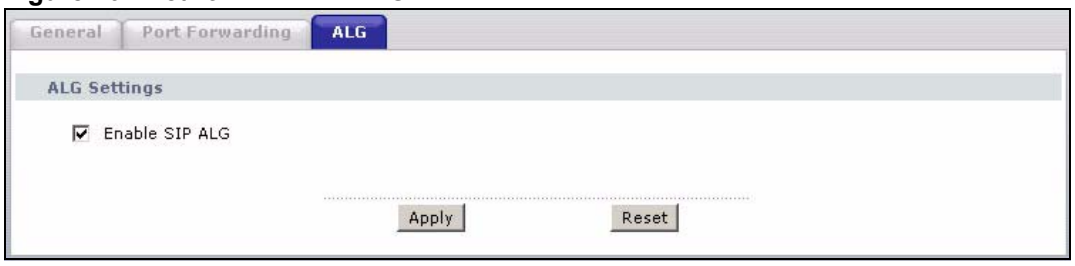
LABEL	DESCRIPTION
Type	Choose the port mapping type from one of the following. **One-to-One**: One-to-One mode maps one local IP address to one global IP address. Note that port numbers do not change for One-to-one NAT mapping type. **Many-to-One**: Many-to-One mode maps multiple local IP addresses to one global IP address. This is equivalent to SUA (i.e., PAT, port address translation), ZyXEL's Single User Account feature that previous ZyXEL routers supported only. **Many-to-Many Overload**: Many-to-Many Overload mode maps multiple local IP addresses to shared global IP addresses. **Many-to-Many No Overload**: Many-to-Many No Overload mode maps each local IP address to unique global IP addresses. **Server**: This type allows you to specify inside servers of different services behind the NAT to be accessible to the outside world.
Local Start IP	This is the starting local IP address (ILA). Local IP addresses are **N/A** for **Server** port mapping.
Local End IP	This is the end local IP address (ILA). If your rule is for all local IP addresses, then enter 0.0.0.0 as the **Local Start IP** address and 255.255.255.255 as the **Local End IP** address. This field is **N/A** for **One-to-One** and **Server** mapping types.
Global Start IP	This is the starting global IP address (IGA). Enter 0.0.0.0 here if you have a dynamic IP address from your ISP.
Global End IP	This is the ending global IP address (IGA). This field is **N/A** for **One-to-One**, **Many-to-One** and **Server** mapping types.
Server Mapping Set	Only available when **Type** is set to **Server**. Select a number from the drop-down menu to choose a port forwarding set.
Edit Details	Click this link to go to the **Port Forwarding** screen to edit a port forwarding set that you have selected in the **Server Mapping Set** field.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save your changes to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

9.6.2 SIP ALG

Some NAT routers may include a SIP Application Layer Gateway (ALG). A SIP ALG allows SIP calls to pass through NAT by examining and translating IP addresses embedded in the data stream. When the ZyXEL Device registers with the SIP register server, the SIP ALG translates the ZyXEL Device's private IP address inside the SIP data stream to a public IP address. You do not need to use STUN or an outbound proxy if your ZyXEL Device is behind a SIP ALG.

Use this screen to enable and disable the SIP (VoIP) ALG in the ZyXEL Device. To access this screen, click **Network > NAT > ALG**.

Figure 70 Network > NAT > ALG



Each field is described in the following table.

Table 45 Network > NAT > ALG

LABEL	DESCRIPTION
Enable SIP ALG	Select this to make sure SIP (VoIP) works correctly with port-forwarding and address-mapping rules.
Apply	Click this to save your changes and to apply them to the ZyXEL Device.
Reset	Click this to return to previously saved configuration.

10 Voice

This chapter provides background information on VoIP and SIP and explains how to configure your device's voice settings.

10.1 Introduction to VoIP

VoIP is the sending of voice signals over Internet Protocol. This allows you to make phone calls and send faxes over the Internet at a fraction of the cost of using the traditional circuit-switched telephone network. You can also use servers to run telephone service applications like PBX services and voice mail. Internet Telephony Service Provider (ITSP) companies provide VoIP service.

Circuit-switched telephone networks require 64 kilobits per second (Kbps) in each direction to handle a telephone call. VoIP can use advanced voice coding techniques with compression to reduce the required bandwidth.

10.2 SIP

The Session Initiation Protocol (SIP) is an application-layer control (signaling) protocol that handles the setting up, altering and tearing down of voice and multimedia sessions over the Internet.

SIP signaling is separate from the media for which it handles sessions. The media that is exchanged during the session can use a different path from that of the signaling. SIP handles telephone calls and can interface with traditional circuit-switched telephone networks.

10.2.1 SIP Identities

A SIP account uses an identity (sometimes referred to as a SIP address). A complete SIP identity is called a SIP URI (Uniform Resource Identifier). A SIP account's URI identifies the SIP account in a way similar to the way an e-mail address identifies an e-mail account. The format of a SIP identity is SIP-Number@SIP-Service-Domain.

10.2.1.1 SIP Number

The SIP number is the part of the SIP URI that comes before the "@" symbol. A SIP number can use letters like in an e-mail address (johndoe@your-ITSP.com for example) or numbers like a telephone number (1122334455@VoIP-provider.com for example).

10.2.1.2 SIP Service Domain

The SIP service domain of the VoIP service provider is the domain name in a SIP URI. For example, if the SIP address is 1122334455@VoIP-provider.com, then "VoIP-provider.com" is the SIP service domain.

10.2.2 SIP Call Progression

The following figure displays the basic steps in the setup and tear down of a SIP call. A calls B.

Table 46 SIP Call Progression

A		B
1. INVITE		
		2. Ringing
		3. OK
4. ACK		
	5.Dialogue (voice traffic)	
6. BYE		
		7. OK

A sends a SIP INVITE request to B. This message is an invitation for B to participate in a SIP telephone call.

6 B sends a response indicating that the telephone is ringing.
7 B sends an OK response after the call is answered.
8 A then sends an ACK message to acknowledge that B has answered the call.
9 Now A and B exchange voice media (talk).
10 After talking, A hangs up and sends a BYE request.
11 B replies with an OK response confirming receipt of the BYE request and the call is terminated.

10.2.3 SIP Servers

SIP is a client-server protocol. A SIP client is an application program or device that sends SIP requests. A SIP server responds to the SIP requests.

When you use SIP to make a VoIP call, it originates at a client and terminates at a server. A SIP client could be a computer or a SIP phone. One device can act as both a SIP client and a SIP server.

10.2.3.1 SIP User Agent

A SIP user agent can make and receive VoIP telephone calls. This means that SIP can be used for peer-to-peer communications even though it is a client-server protocol. In the following figure, either A or B can act as a SIP user agent client to initiate a call. A and B can also both act as a SIP user agent to receive the call.

Figure 71 SIP User Agent

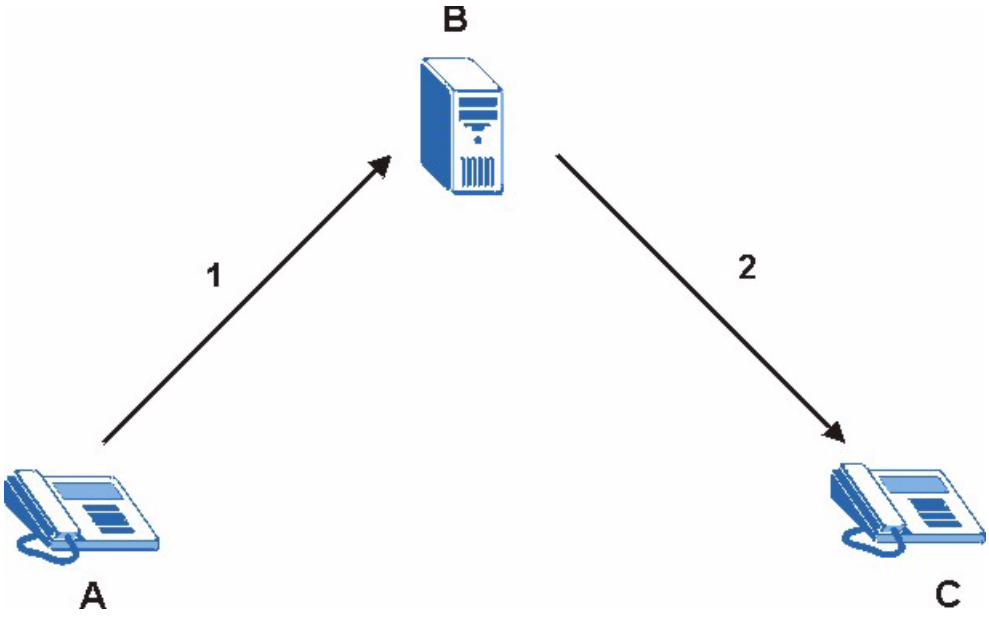
10.2.3.2 SIP Proxy Server

A SIP proxy server receives requests from clients and forwards them to another server.

In the following example, you want to use client device A to call someone who is using client device C.

1. The client device (A in the figure) sends a call invitation to the SIP proxy server (B).
2. The SIP proxy server forwards the call invitation to C.

Figure 72 SIP Proxy Server



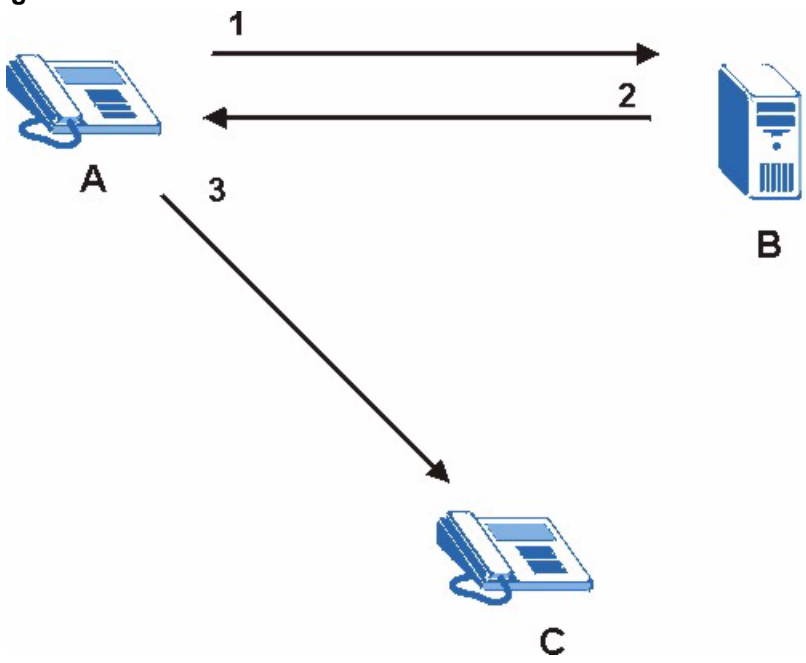
10.2.3.3 SIP Redirect Server

A SIP redirect server accepts SIP requests, translates the destination address to an IP address and sends the translated IP address back to the device that sent the request. Then the client device that originally sent the request can send requests to the IP address that it received back from the redirect server. Redirect servers do not initiate SIP requests.

In the following example, you want to use client device A to call someone who is using client device C.

1. Client device A sends a call invitation for C to the SIP redirect server (B).
2. The SIP redirect server sends the invitation back to A with C's IP address (or domain name).
3. Client device A then sends the call invitation to client device C.

Figure 73 SIP Redirect Server



10.2.3.4 SIP Register Server

A SIP register server maintains a database of SIP identity-to-IP address (or domain name) mapping. The register server checks your user name and password when you register.

10.2.4 RTP

When you make a VoIP call using SIP, the RTP (Real time Transport Protocol) is used to handle voice data transfer. See RFC 1889 for details on RTP.

10.2.5 Pulse Code Modulation

Pulse Code Modulation (PCM) measures analog signal amplitudes at regular time intervals and converts them into bits.

10.2.6 Voice Coding

A codec (coder/decoder) codes analog voice signals into digital signals and decodes the digital signals back into analog voice signals. The ZyXEL Device supports the following codecs.

- G.711 is a Pulse Code Modulation (PCM) waveform codec. PCM measures analog signal amplitudes at regular time intervals and converts them into digital samples. G.711 provides very good sound quality but requires 64 kbps of bandwidth.
- G.726 is an Adaptive Differential PCM (ADPCM) waveform codec that uses a lower bitrate than standard PCM conversion. ADPCM converts analog audio into digital signals based on the difference between each audio sample and a prediction based on previous samples. The more similar the audio sample is to the prediction, the less space needed to describe it. G.726 operates at 16, 24, 32 or 40 kbps.

- G.729 is an Analysis-by-Synthesis (AbS) hybrid waveform codec that uses a filter based on information about how the human vocal tract produces sounds. G.729 provides good sound quality and reduces the required bandwidth to 8 kbps.

10.2.7 PSTN Call Setup Signaling

Dual-Tone MultiFrequency (DTMF) signaling uses pairs of frequencies (one lower frequency and one higher frequency) to set up calls. It is also known as Touch Tone®. Each of the keys on a DTMF telephone corresponds to a different pair of frequencies.

Pulse dialing sends a series of clicks to the local phone office in order to dial numbers.[3]

10.2.8 MWI (Message Waiting Indication)

Enable Message Waiting Indication (MWI) enables your phone to give you a message–waiting (beeping) dial tone when you have a voice message(s). Your VoIP service provider must have a messaging system that sends message waiting status SIP packets as defined in RFC 3842.

10.2.9 Custom Tones (IVR)

IVR (Interactive Voice Response) is a feature that allows you to use your telephone to interact with the ZyXEL Device. The ZyXEL Device allows you to record custom tones for the **Caller Ringing Tone** and **On Hold Tone** functions. The same recordings apply to both the caller ringing and on hold tones.

Table 47 Custom Tones Details

LABEL	DESCRIPTION
Total Time for All Tones	128 seconds for all custom tones combined
Time per Individual Tone	20 seconds
Total Number of Tones Recordable	8 You can record up to 8 different custom tones but the total time must be 128 seconds or less.

10.2.9.1 Recording Custom Tones

Use the following steps if you would like to create new tones or change your tones:

1. Pick up the phone and press "****" on your phone's keypad and wait for the message that says you are in the configuration menu.
2. Press a number from 1101~1108 on your phone followed by the "#" key.
3. Play your desired music or voice recording into the receiver's mouthpiece. Press the "#" key.
4. You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

10.2.9.2 Listening to Custom Tones

Do the following to listen to a custom tone:

3. The ZyXEL Device does not support pulse dialing at the time of writing.

1. Pick up the phone and press "****" on your phone's keypad and wait for the message that says you are in the configuration menu.
2. Press a number from 1201~1208 followed by the "#" key to listen to the tone.
3. You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

10.2.9.3 Deleting Custom Tones

Do the following to delete a custom tone:

1. Pick up the phone and press "****" on your phone's keypad and wait for the message that says you are in the configuration menu.
2. Press a number from 1301~1308 followed by the "#" key to delete the tone of your choice. Press 14 followed by the "#" key if you wish to clear all your custom tones.

You can continue to add, listen to, or delete tones, or you can hang up the receiver when you are done.

10.3 Quality of Service (QoS)

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay, and the networking methods used to provide bandwidth for real-time multimedia applications.

10.3.1 Type of Service (ToS)

Network traffic can be classified by setting the ToS (Type of Service) values at the data source (for example, at the ZyXEL Device) so a server can decide the best method of delivery, that is the least cost, fastest route and so on.

10.3.2 DiffServ

DiffServ is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.[4]

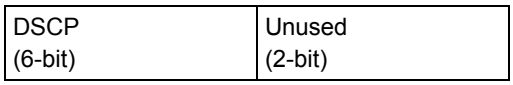
10.3.2.1 DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.

4. The ZyXEL Device does not support DiffServ at the time of writing.

Figure 74 DiffServ: Differentiated Service Field



The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different priorities of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

10.3.3 VLAN Tagging

Virtual Local Area Network (VLAN) allows a physical network to be partitioned into multiple logical networks. Only stations within the same group can communicate with each other.

Your ZyXEL Device can add IEEE 802.1Q VLAN ID tags to voice frames that it sends to the network. This allows the ZyXEL Device to communicate with a SIP server that is a member of the same VLAN group. Some ISPs use the VLAN tag to identify voice traffic and give it priority over other traffic.

10.4 SIP Settings Screen

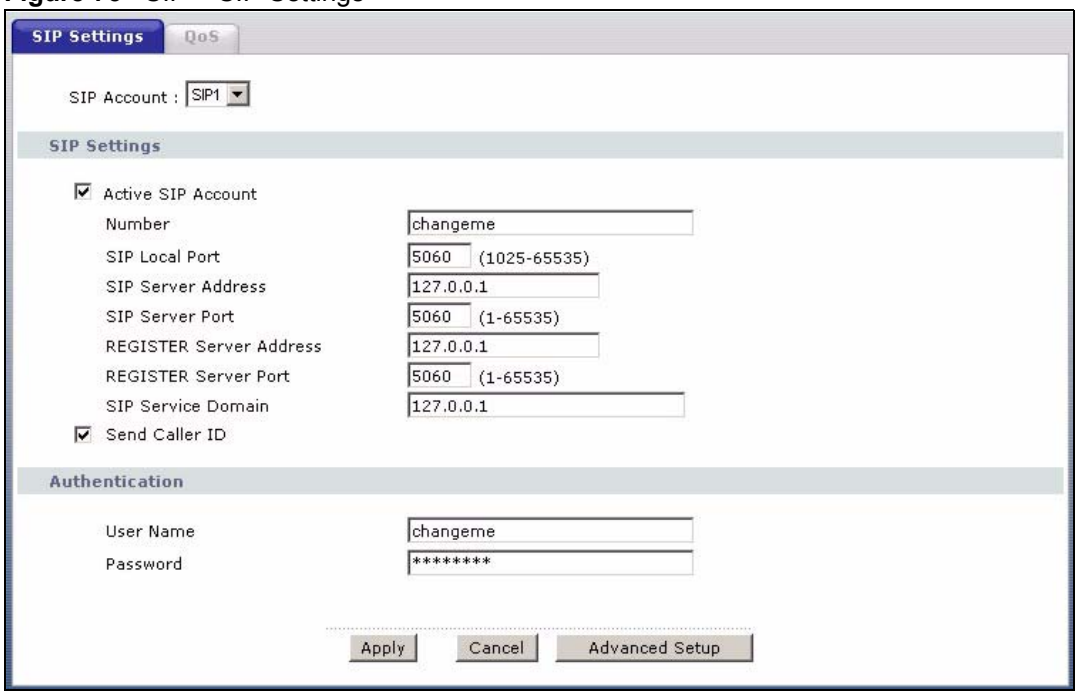
The ZyXEL Device uses a SIP account to make outgoing VoIP calls and check if an incoming call's destination number matches your SIP account's SIP number. In order to make or receive a VoIP call, you need to enable and configure a SIP account, and map it to a phone port. The SIP account contains information that allows your ZyXEL Device to connect to your VoIP service provider.

If you want to make only peer-to-peer VoIP calls, there is no VoIP service provider involved, so the SIP account information does not have to match a real VoIP service provider's SIP account. You can make up the SIP numbers. However, you should still activate a SIP account and configure its number and map it to a phone port, so that the person you call knows what SIP number you are using and the ZyXEL Device knows to which phone port it should forward an incoming VoIP call. You must use speed dial to make peer-to-peer VoIP calls.

See Section 10.8 on page 142 for how to map a SIP account to a phone port.

Use this screen to maintain basic information about each SIP account. You can also enable and disable each SIP account. To access this screen, click **VoIP > SIP > SIP Settings**.

Figure 75 SIP > SIP Settings



Each field is described in the following table.

Table 48 SIP > SIP Settings

LABEL	DESCRIPTION
SIP Account	Select the SIP account you want to see in this screen. If you change this field, the screen automatically refreshes.
SIP Settings	
Active SIP Account	Select this if you want the ZyXEL Device to use this account. Clear it if you do not want the ZyXEL Device to use this account.
Number	Enter your SIP number. In the full SIP URI, this is the part before the @ symbol. You can use up to 127 printable ASCII characters.
SIP Local Port	Enter the ZyXEL Device's listening port number, if your VoIP service provider gave you one. Otherwise, keep the default value.
SIP Server Address	Enter the IP address or domain name of the SIP server provided by your VoIP service provider. You can use up to 95 printable ASCII characters. It does not matter whether the SIP server is a proxy, redirect or register server.
SIP Server Port	Enter the SIP server's listening port number, if your VoIP service provider gave you one. Otherwise, keep the default value.
REGISTER Server Address	Enter the IP address or domain name of the SIP register server, if your VoIP service provider gave you one. Otherwise, enter the same address you entered in the **SIP Server Address** field. You can use up to 95 printable ASCII characters.
REGISTER Server Port	Enter the SIP register server's listening port number, if your VoIP service provider gave you one. Otherwise, enter the same port number you entered in the **SIP Server Port** field.
SIP Service Domain	Enter the SIP service domain name. In the full SIP URI, this is the part after the @ symbol. You can use up to 127 printable ASCII Extended set characters.
Send Caller ID	Select this if you want to send identification when you make VoIP phone calls. Clear this if you do not want to send identification.
Authentication	

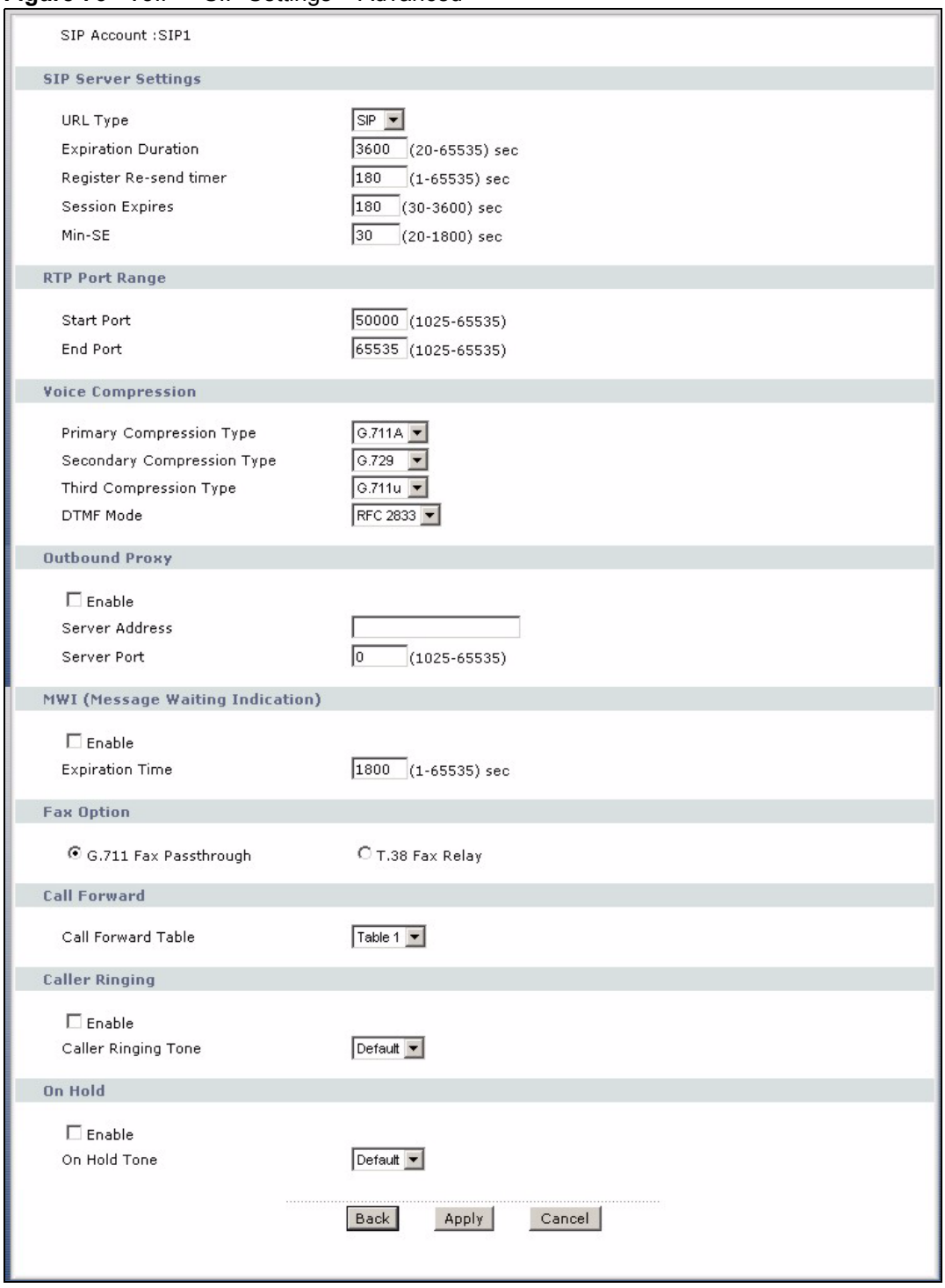
Table 48 SIP > SIP Settings

LABEL	DESCRIPTION
User Name	Enter the user name for registering this SIP account, exactly as it was given to you. You can use up to 95 printable ASCII characters.
Password	Enter the user name for registering this SIP account, exactly as it was given to you. You can use up to 95 printable ASCII Extended set characters.
Apply	Click this to save your changes and to apply them to the ZyXEL Device.
Cancel	Click this to set every field in this screen to its last-saved value.
Advanced Setup	Click this to edit the advanced settings for this SIP account. The **Advanced SIP Setup** screen appears.

10.5 Advanced SIP Setup Screen

Click **VoIP > SIP > SIP Settings** to open the **SIP Settings** screen. Select a SIP account and click **Advanced Setup** to open the **Advanced SIP Setup** screen. Use this screen to maintain advanced settings for each SIP account.

Figure 76 VoIP > SIP Settings > Advanced



Each field is described in the following table.

Table 49 VoIP > SIP Settings > Advanced

LABEL	DESCRIPTION
SIP Account	This field displays the SIP account you see in this screen.
SIP Server Settings	

Table 49 VoIP > SIP Settings > Advanced

LABEL	DESCRIPTION
URL Type	Select whether or not to include the SIP service domain name when the ZyXEL Device sends the SIP number. **SIP** - include the SIP service domain name. **TEL** - do not include the SIP service domain name.
Expiration Duration	Enter the number of seconds your SIP account is registered with the SIP register server before it is deleted. The ZyXEL Device automatically tries to re-register your SIP account when one-half of this time has passed. (The SIP register server might have a different expiration.)
Register Re-send timer	Enter the number of seconds the ZyXEL Device waits before it tries again to register the SIP account, if the first try failed or if there is no response.
Session Expires	Enter the number of seconds the ZyXEL Device lets a SIP session remain idle (without traffic) before it automatically disconnects the session.
Min-SE	Enter the minimum number of seconds the ZyXEL Device lets a SIP session remain idle (without traffic) before it automatically disconnects the session. When two SIP devices start a SIP session, they must agree on an expiration time for idle sessions. This field is the shortest expiration time that the ZyXEL Device accepts.
RTP Port Range	
Start Port End Port	Enter the listening port number(s) for RTP traffic, if your VoIP service provider gave you this information. Otherwise, keep the default values. To enter one port number, enter the port number in the **Start Port** and **End Port** fields. To enter a range of ports, • enter the port number at the beginning of the range in the **Start Port** field. • enter the port number at the end of the range in the **End Port** field.
Voice Compression	Select the type of voice coder/decoder (codec) that you want the ZyXEL Device to use. G.711 provides higher voice quality but requires more bandwidth (64 kbps). • **G.711A** is typically used in Europe. • **G.711u** is typically used in North America and Japan. **G.726** operates at **16**, **24**, **32** or **40** kbps. By contrast, **G.729** only requires 8 kbps. The ZyXEL Device must use the same codec as the peer. When two SIP devices start a SIP session, they must agree on a codec.
Primary Compression Type	Select the ZyXEL Device's first choice for voice coder/decoder.
Secondary Compression Type	Select the ZyXEL Device's second choice for voice coder/decoder. Select **None** if you only want the ZyXEL Device to accept the first choice.
Third Compression Type	Select the ZyXEL Device's third choice for voice coder/decoder. Select **None** if you only want the ZyXEL Device to accept the first or second choice.
DTMF Mode	Control how the ZyXEL Device handles the tones that your telephone makes when you push its buttons. You should use the same mode your VoIP service provider uses. **RFC 2833** - send the DTMF tones in RTP packets. **PCM** - send the DTMF tones in the voice data stream. This method works best when you are using a codec that does not use compression (like G.711). Codecs that use compression (like G.729 and G.726) can distort the tones. **SIP INFO** - send the DTMF tones in SIP messages.
Outbound Proxy	

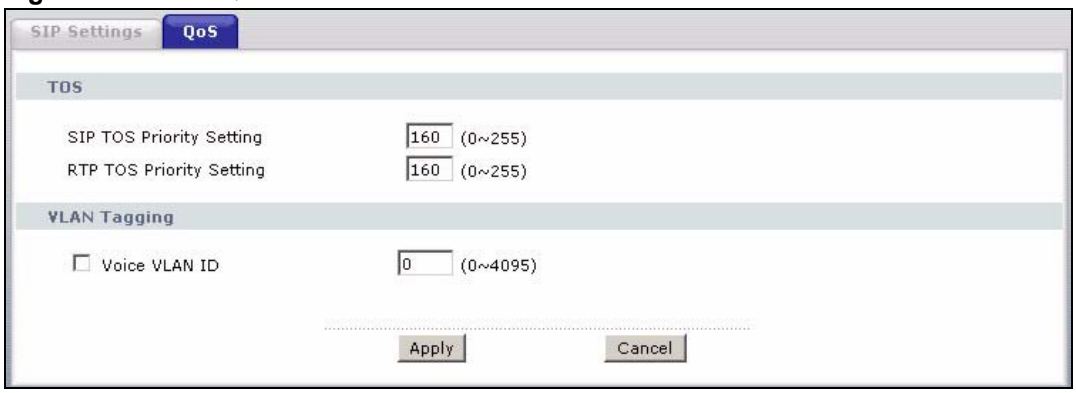
Table 49 VoIP > SIP Settings > Advanced

LABEL	DESCRIPTION
Enable	Select this if your VoIP service provider has a SIP outbound server to handle voice calls. This allows the ZyXEL Device to work with any type of NAT router and eliminates the need for STUN or a SIP ALG. Turn off any SIP ALG on a NAT router in front of the ZyXEL Device to keep it from retranslating the IP address (since this is already handled by the outbound proxy server).
Server Address	Enter the IP address or domain name of the SIP outbound proxy server.
Server Port	Enter the SIP outbound proxy server's listening port, if your VoIP service provider gave you one. Otherwise, keep the default value.
MWI (Message Waiting Indication)	
Enable	Select this if you want to hear a waiting (beeping) dial tone on your phone when you have at least one voice message. Your VoIP service provider must support this feature.
Expiration Time	Keep the default value for this field, unless your VoIP service provider tells you to change it. Enter the number of seconds the SIP server should provide the message waiting service each time the ZyXEL Device subscribes to the service. Before this time passes, the ZyXEL Device automatically subscribes again.
Fax Option	This field controls how the ZyXEL Device handles fax messages.
G.711 Fax Passthrough	Select this if the ZyXEL Device should use G.711 to send fax messages. The peer devices must also use G.711.
T.38 Fax Relay	Select this if the ZyXEL Device should send fax messages as UDP or TCP/IP packets through IP networks. This provides better quality, but it may have inter-operability problems. The peer devices must also use T.38.
Call Forward	
Call Forward Table	Select which call forwarding table you want the ZyXEL Device to use for incoming calls. You set up these tables in **VoIP** > **Phone Book** > **Incoming Call Policy**.
Caller Ringing	
Enable	Select the check box if you want to specify what tone people hear when they call you. The ZyXEL Device provides a default tone, but you can add additional tones using IVR. See Section 10.2.9 on page 133 for more information.
Caller Ringing Tone	Select the tone you want people to hear when they call you. You should set up these tones using IVR first. See Section 10.2.9 on page 133 for more information.
On Hold	
Enable	Select the check box if you want to specify what tone people hear when you put them on hold. The ZyXEL Device provides a default tone, but you can add additional tones using IVR. See Section 10.2.9 on page 133 for more information.
On Hold Tone	Select the tone you want people to hear when you put them on hold. You should setup these tones using IVR first. See Section 10.2.9 on page 133 for more information.
Back	Click this to return to the **SIP Settings** screen without saving your changes.
Apply	Click this to save your changes and to apply them to the ZyXEL Device.
Cancel	Click this to set every field in this screen to its last-saved value.

10.6 SIP QoS Screen

Use this screen to maintain ToS and VLAN settings for the ZyXEL Device. To access this screen, click **VoIP > SIP > QoS**.

Figure 77 SIP > QoS



Each field is described in the following table.

Table 50 SIP > QoS

LABEL	DESCRIPTION
SIP TOS Priority Setting	Enter the priority for SIP voice transmissions. The ZyXEL Device creates Type of Service priority tags with this priority to voice traffic that it transmits.
RTP TOS Priority Setting	Enter the priority for RTP voice transmissions. The ZyXEL Device creates Type of Service priority tags with this priority to RTP traffic that it transmits.
Voice VLAN ID	Select this if the ZyXEL Device has to be a member of a VLAN to communicate with the SIP server. Ask your network administrator, if you are not sure. Enter the VLAN ID provided by your network administrator in the field on the right. Your LAN and gateway must be configured to use VLAN tags. Otherwise, clear this field.
Apply	Click this to save your changes and to apply them to the ZyXEL Device.
Cancel	Click this to set every field in this screen to its last-saved value.

10.7 Phone

You can configure the volume, echo cancellation and VAD settings for each individual phone port on the ZyXEL Device. You can also select which SIP account to use for making outgoing calls.

10.7.1 Voice Activity Detection/Silence Suppression

Voice Activity Detection (VAD) detects whether or not speech is present. This lets the ZyXEL Device reduce the bandwidth that a call uses by not transmitting “silent packets” when you are not speaking.

10.7.2 Comfort Noise Generation

When using VAD, the ZyXEL Device generates comfort noise when the other party is not speaking. The comfort noise lets you know that the line is still connected as total silence could easily be mistaken for a lost connection.

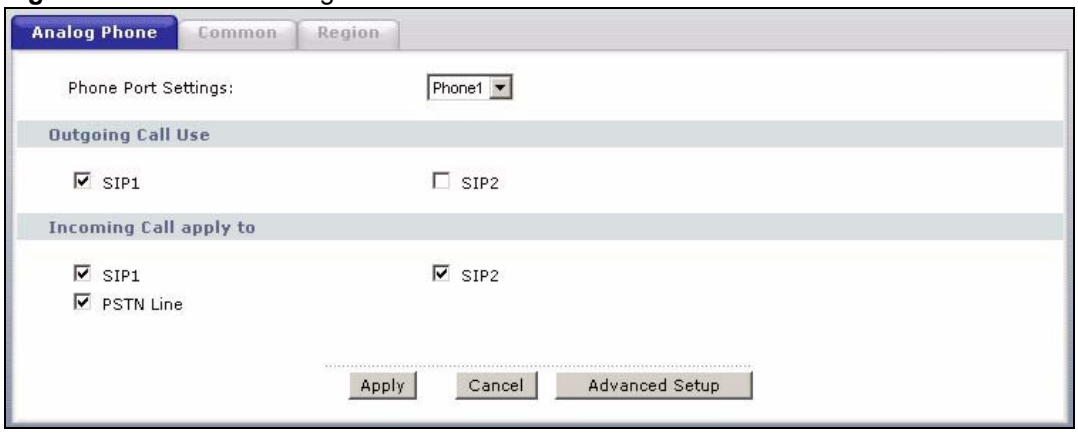
10.7.3 Echo Cancellation

G.168 is an ITU-T standard for eliminating the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.

10.8 Analog Phone Screen

Use this screen to control which SIP accounts and PSTN line each phone uses. To access this screen, click **VoIP > Phone > Analog Phone**.

Figure 78 Phone > Analog Phone



Each field is described in the following table.

Table 51 Phone > Analog Phone

LABEL	DESCRIPTION
Phone Port Settings	Select the phone port you want to see in this screen. If you change this field, the screen automatically refreshes.
Outgoing Call Use	If you select both SIP accounts, the ZyXEL Device tries to use SIP2 first. If you do not select a SIP account, you cannot make VoIP calls on the phone connected to this phone port.
SIP1	Select this if you want this phone port to use the SIP1 account when it makes calls.
SIP2	Select this if you want this phone port to use the SIP2 account when it makes calls.
Incoming Call apply to	If you select more than one source for incoming calls, there is no way to distinguish between them when you receive phone calls. If you do not select a source for incoming calls, you cannot receive any calls on this phone port.
SIP1	Select this if you want to receive phone calls for the SIP1 account on this phone port.
SIP2	Select this if you want to receive phone calls for the SIP2 account on this phone port.

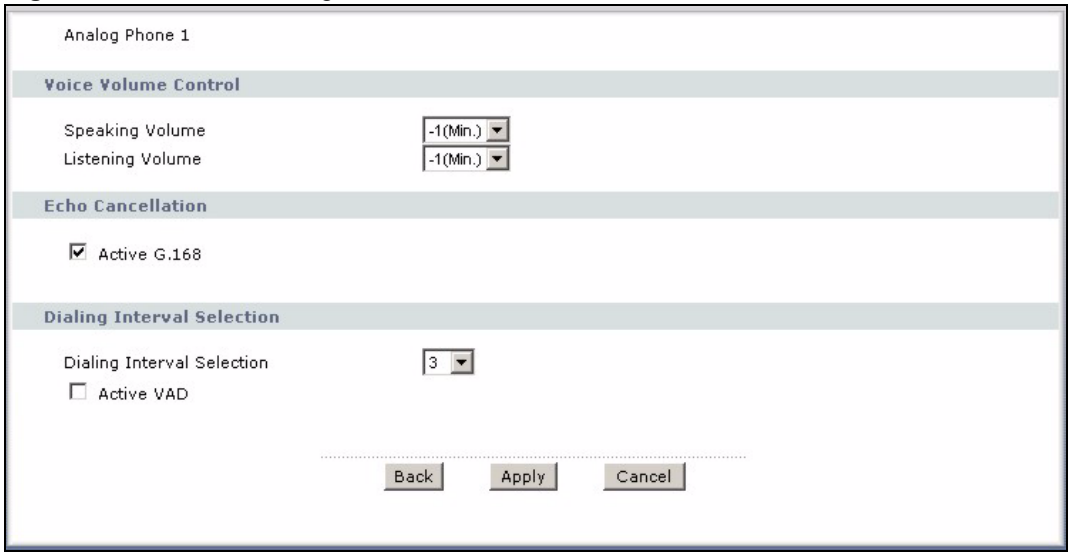
Table 51 Phone > Analog Phone

LABEL	DESCRIPTION
PSTN Line ("L" models only)	Select this if you want to receive phone calls from the PSTN line (that do not use the Internet) on this phone port. If you select more than one source for incoming calls, there is no way to distinguish between them when you receive phone calls. Note: When the ZyXEL Device does not have power, regardless of the settings you configure, the phone(s) connected to the **PHONE** port(s) can still be used for making PSTN calls. Only one phone can be in use at a time.
Apply	Click this to save your changes and to apply them to the ZyXEL Device.
Cancel	Click this to set every field in this screen to its last-saved value.
Advanced Setup	Click this to edit the advanced settings for this phone port. The **Advanced Analog Phone Setup** screen appears.

10.9 Advanced Analog Phone Setup Screen

Use this screen to edit advanced settings for each phone port. To access this screen, click **Advanced Setup** in **VoIP > Phone > Analog Phone**.

Figure 79 Phone > Analog Phone > Advanced



Each field is described in the following table.

Table 52 Phone > Analog Phone > Advanced

LABEL	DESCRIPTION
Analog Phone	This field displays the analog phone port you see in this screen.
Voice Volume Control	
Speaking Volume	Enter the loudness that the ZyXEL Device uses for speech that it sends to the peer device. -1 is the quietest, and 1 is the loudest.

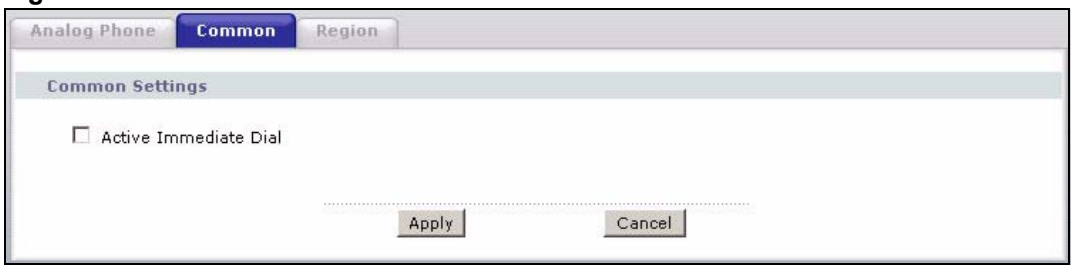
Table 52 Phone > Analog Phone > Advanced

LABEL	DESCRIPTION
Listening Volume	Enter the loudness that the ZyXEL Device uses for speech that it receives from the peer device. -1 is the quietest, and 1 is the loudest.
Echo Cancellation	
Active G.168	Select this if you want to eliminate the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.
Dialing Interval Select	
Dialing Interval Select	Enter the number of seconds the ZyXEL Device should wait after you stop dialing numbers before it makes the phone call. The value depends on how quickly you dial phone numbers. If you select **Active Immediate Dial** in **VoIP > Phone > Common**, you can press the pound key (#) to tell the ZyXEL Device to make the phone call immediately, regardless of this setting.
Active VAD	Select this if the ZyXEL Device should stop transmitting when you are not speaking. This reduces the bandwidth the ZyXEL Device uses.
Back	Click this to return to the **Analog Phone** screen without saving your changes.
Apply	Click this to save your changes.
Cancel	Click this to set every field in this screen to its last-saved value.

10.10 Common Phone Settings Screen

Use this screen to activate and deactivate immediate dialing. To access this screen, click **VoIP > Phone > Common**.

Figure 80 Phone > Common



Each field is described in the following table.

Table 53 Phone > Common

LABEL	DESCRIPTION
Immediate Dial	
Active Immediate Dial	Select this if you want to use the pound key (#) to tell the ZyXEL Device to make the phone call immediately, instead of waiting the number of seconds you selected in the **Dialing Interval Select** in **VoIP > Phone > Analog Phone**. If you select this, dial the phone number, and then press the pound key. The ZyXEL Device makes the call immediately, instead of waiting. You can still wait, if you want.
Apply	Click this to save your changes and to apply them to the ZyXEL Device.
Cancel	Click this to set every field in this screen to its last-saved value.

10.11 Phone Services Overview

Supplementary services such as call hold, call waiting, call transfer, etc. are generally available from your VoIP service provider. The ZyXEL Device supports the following services:

- Call Hold
- Call Waiting
- Making a Second Call
- Call Transfer
- Call Forwarding (see Section 10.14 on page 150)
- Three-Way Conference
- Internal Calls
- Call Park and Pickup
- Do not Disturb

To take full advantage of the supplementary phone services available through the ZyXEL Device's phone ports, you may need to subscribe to the services from your VoIP service provider.

10.11.1 The Flash Key

Flashing means to press the hook for a short period of time (a few hundred milliseconds) before releasing it. On newer telephones, there should be a "flash" key (button) that generates the signal electronically. If the flash key is not available, you can tap (press and immediately release) the hook by hand to achieve the same effect. However, using the flash key is preferred since the timing is much more precise. With manual tapping, if the duration is too long, it may be interpreted as hanging up by the ZyXEL Device.

You can invoke all the supplementary services by using the flash key.

10.11.2 Europe Type Supplementary Phone Services

This section describes how to use supplementary phone services with the **Europe Type Call Service Mode**. Commands for supplementary services are listed in the table below.

After pressing the flash key, if you do not issue the sub-command before the default sub-command timeout (2 seconds) expires or issue an invalid sub-command, the current operation will be aborted.

Table 54 European Flash Key Commands

COMMAND	SUB-COMMAND	DESCRIPTION
Flash		Put a current call on hold to place a second call. Switch back to the call (if there is no second call).
Flash	0	Drop the call presently on hold or reject an incoming call which is waiting for answer.

Table 54 European Flash Key Commands

COMMAND	SUB-COMMAND	DESCRIPTION
Flash	1	Disconnect the current phone connection and answer the incoming call or resume with caller presently on hold.
Flash	2	1. Switch back and forth between two calls. 2. Put a current call on hold to answer an incoming call. 3. Separate the current three-way conference call into two individual calls (one is on-line, the other is on hold).
Flash	3	Create three-way conference connection.
Flash	*98#	Transfer the call to another phone.

10.11.2.1 European Call Hold

Call hold allows you to put a call (**A**) on hold by pressing the flash key.

If you have another call, press the flash key and then “2” to switch back and forth between caller **A** and **B** by putting either one on hold.

Press the flash key and then “0” to disconnect the call presently on hold and keep the current call on line.

Press the flash key and then “1” to disconnect the current call and resume the call on hold.

If you hang up the phone but a caller is still on hold, there will be a remind ring.

10.11.2.2 European Call Waiting

This allows you to place a call on hold while you answer another incoming call on the same telephone (directory) number.

If there is a second call to a telephone number, you will hear a call waiting tone. Take one of the following actions.

- Reject the second call.
  Press the flash key and then press “0”.
- Disconnect the first call and answer the second call.
  Either press the flash key and press “1”, or just hang up the phone and then answer the phone after it rings.
- Put the first call on hold and answer the second call.
  Press the flash key and then “2”.

10.11.2.3 European Call Transfer

Do the following to transfer an incoming call (that you have answered) to another phone.

1. Press the flash key to put the caller on hold.
2. When you hear the dial tone, dial “*98#” followed by the number to which you want to transfer the call. to operate the Intercom.
3. After you hear the ring signal or the second party answers it, hang up the phone.

10.11.2.4 European Three-Way Conference

Use the following steps to make three-way conference calls.

1. When you are on the phone talking to someone, press the flash key to put the caller on hold and get a dial tone.

2 Dial a phone number directly to make another call.
3 When the second call is answered, press the flash key and press “3” to create a three-way conversation.
4 Hang up the phone to drop the connection.
5 If you want to separate the activated three-way conference into two individual connections (one is on-line, the other is on hold), press the flash key and press “2”.

10.11.3 USA Type Supplementary Services

This section describes how to use supplementary phone services with the **USA Type Call Service Mode**. Commands for supplementary services are listed in the table below.

After pressing the flash key, if you do not issue the sub-command before the default sub-command timeout (2 seconds) expires or issue an invalid sub-command, the current operation will be aborted.

Table 55 USA Flash Key Commands

COMMAND	SUB-COMMAND	DESCRIPTION
Flash		Put a current call on hold to place a second call. After the second call is successful, press the flash key again to have a three-way conference call. Put a current call on hold to answer an incoming call.
Flash	*98#	Transfer the call to another phone.

10.11.3.1 USA Call Hold

Call hold allows you to put a call (**A**) on hold by pressing the flash key.

If you have another call, press the flash key to switch back and forth between caller **A** and **B** by putting either one on hold.

If you hang up the phone but a caller is still on hold, there will be a remind ring.

10.11.3.2 USA Call Waiting

This allows you to place a call on hold while you answer another incoming call on the same telephone (directory) number.

If there is a second call to your telephone number, you will hear a call waiting tone.

Press the flash key to put the first call on hold and answer the second call.

10.11.3.3 USA Call Transfer

Do the following to transfer an incoming call (that you have answered) to another phone.

1 Press the flash key to put the caller on hold.
2 When you hear the dial tone, dial “*98#” followed by the number to which you want to transfer the call. to operate the Intercom.
3 After you hear the ring signal or the second party answers it, hang up the phone.

10.11.3.4 USA Three-Way Conference

Use the following steps to make three-way conference calls.

1 When you are on the phone talking to someone (party A), press the flash key to put the caller on hold and get a dial tone.

2 Dial a phone number directly to make another call (to party B).
3 When party B answers the second call, press the flash key to create a three-way conversation.
4 Hang up the phone to drop the connection.
5 If you want to separate the activated three-way conference into two individual connections (with party A on-line and party B on hold), press the flash key.
6 If you want to go back to the three-way conversation, press the flash key again.
7 If you want to separate the activated three-way conference into two individual connections again, press the flash key. This time the party B is on-line and party A is on hold.

10.12 Phone Region Screen

Use this screen to maintain settings that depend on which region of the world the ZyXEL Device is in. To access this screen, click **VoIP > Phone > Region**.

Figure 81 VoIP > Phone > Region

Each field is described in the following table.

Table 56 VoIP > Phone > Region

LABEL	DESCRIPTION
Region Settings	Select the place in which the ZyXEL Device is located.
Call Service Mode	Select the mode for supplementary phone services (call hold, call waiting, call transfer and three-way conference calls) that your VoIP service provider supports. **Europe Type** - use supplementary phone services in European mode **USA Type** - use supplementary phone services American mode You might have to subscribe to these services to use them. Contact your VoIP service provider.
Apply	Click this to save your changes and to apply them to the ZyXEL Device.
Cancel	Click this to set every field in this screen to its last-saved value.

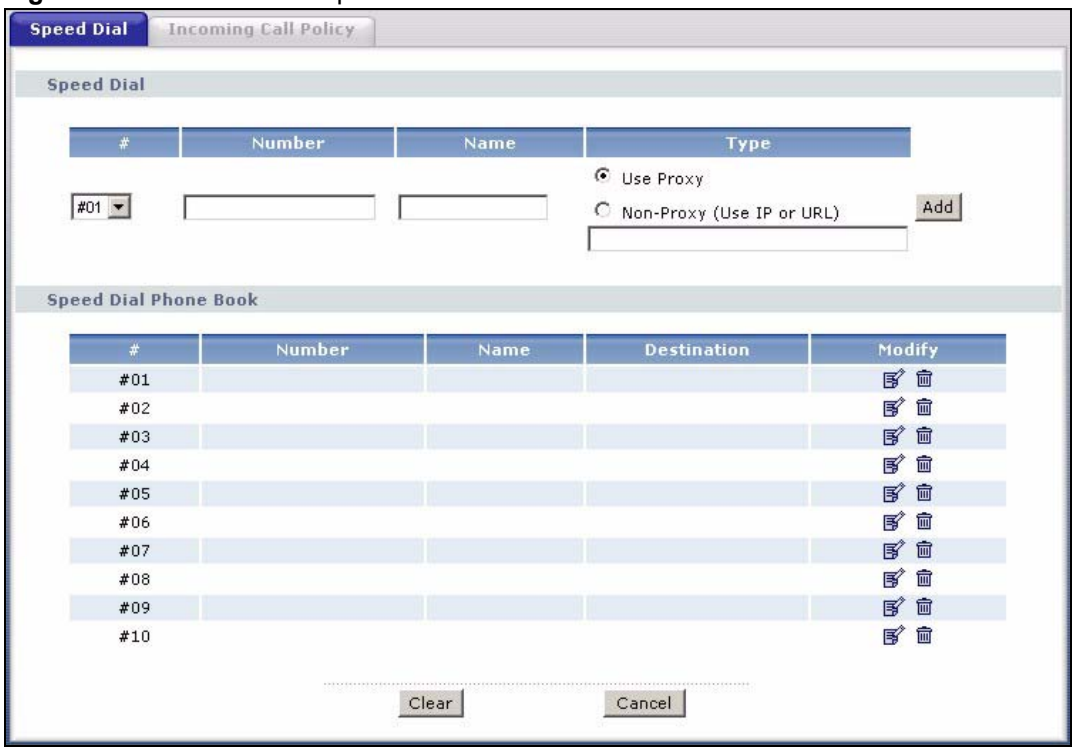
10.13 Speed Dial

Speed dial provides shortcuts for dialing frequently used (VoIP) phone numbers. You also have to create speed-dial entries if you want to make peer-to-peer calls or call SIP numbers that contain letters. Once you have configured a speed dial rule, you can use a shortcut (the speed dial number, #01 for example) on your phone's keypad to call the phone number.

Use this screen to add, edit, or remove speed-dial numbers for outgoing calls. To access this screen, click **VoIP > Phone Book > Speed Dial**.

In peer-to-peer calls, you call another VoIP device directly without going through a VoIP service provider's SIP server. Select **Non-Proxy (Use IP or URL)** in the **Type** column and enter the callee's IP address or domain name. The ZyXEL Device sends SIP INVITE requests to the peer VoIP device when you use the speed dial entry.

Figure 82 Phone Book > Speed Dial



Each field is described in the following table.

Table 57 Phone Book > Speed Dial

LABEL	DESCRIPTION
Speed Dial	Use this section to create or edit speed-dial entries.
#	Select the speed-dial number you want to use for this phone number.
Number	Enter the SIP number you want the ZyXEL Device to call when you dial the speed-dial number.
Name	Enter a name to identify the party you call when you dial the speed-dial number. You can use up to 127 printable ASCII characters.
Type	Select **Use Proxy** if you want to use one of your SIP accounts to call this phone number. Select **Non-Proxy (Use IP or URL)** if you want to use a different SIP server or if you want to make a peer-to-peer call. In this case, enter the IP address or domain name of the SIP server or the other party in the field below.
Add	Click this to use the information in the **Speed Dial** section to update the **Speed Dial Phone Book** section.
Speed Dial Phone Book	Use this section to look at all the speed-dial entries and to erase them.
#	This field displays the speed-dial number you should dial to use this entry.

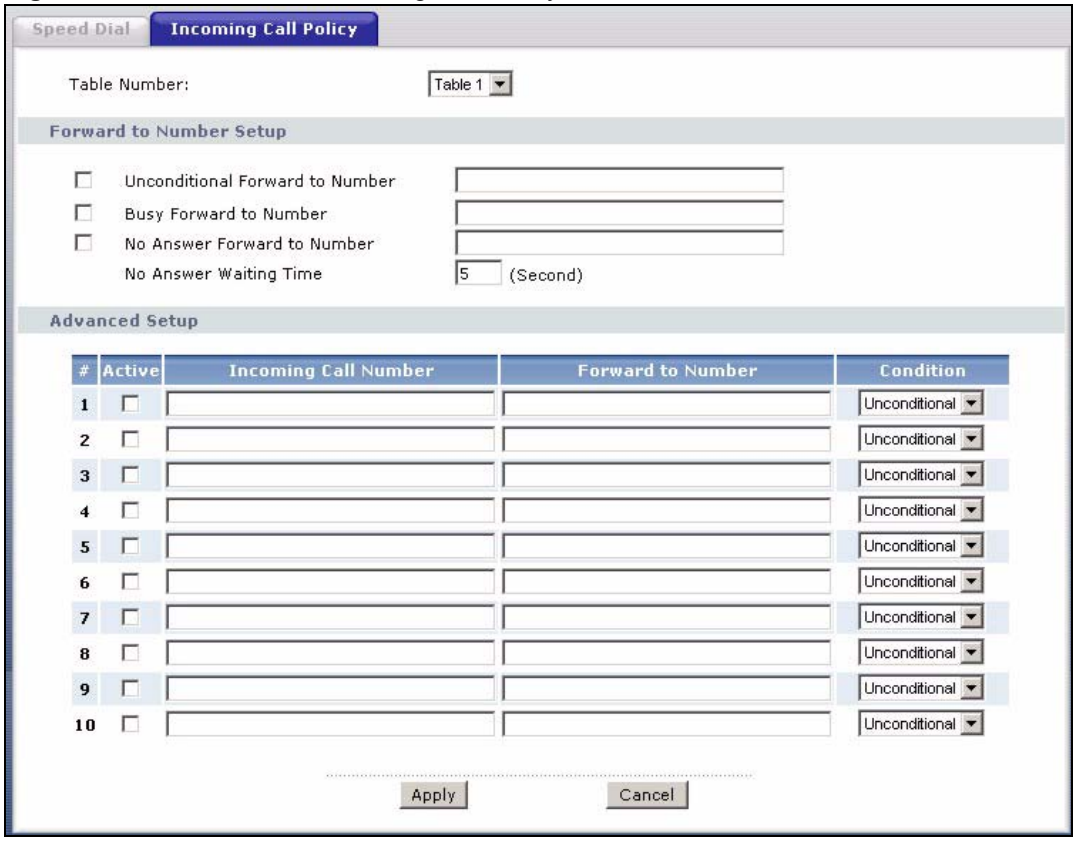
Table 57 Phone Book > Speed Dial

LABEL	DESCRIPTION
Number	This field displays the SIP number the ZyXEL Device calls when you dial the speed-dial number.
Name	This field displays the name of the party you call when you dial the speed-dial number.
Destination	This field is blank, if the speed-dial entry uses one of your SIP accounts. Otherwise, this field shows the IP address or domain name of the SIP server or other party. (This field corresponds with the **Type** field in the **Speed Dial** section.)
Modify	Use this field to edit or erase the speed-dial entry. Click the **edit** icon to copy the information for this speed-dial entry into the **Speed Dial** section, where you can change it. Click the **remove** icon to erase this speed-dial entry.
Clear	Click this to erase all the speed-dial entries.
Cancel	Click this to set every field in this screen to its last-saved value.

10.14 Incoming Call Policy Screen

Use this screen to maintain rules for handling incoming calls. You can block, redirect, or accept them. To access this screen, click **VoIP > Phone Book > Incoming Call Policy**.

Figure 83 Phone Book > Incoming Call Policy



You can create two sets of call-forwarding rules. Each one is stored in a call-forwarding table. Each field is described in the following table.

Table 58 Phone Book > Incoming Call Policy

LABEL	DESCRIPTION
Table Number	Select the call-forwarding table you want to see in this screen. If you change this field, the screen automatically refreshes.
Forward to Number Setup	The ZyXEL Device checks these rules, in the order in which they appear, after it checks the rules in the **Advanced Setup** section.
Unconditional Forward to Number	Select this if you want the ZyXEL Device to forward all incoming calls to the specified phone number, regardless of other rules in the **Forward to Number** section. Specify the phone number in the field on the right.
Busy Forward to Number	Select this if you want the ZyXEL Device to forward incoming calls to the specified phone number if the phone port is busy. Specify the phone number in the field on the right. If you have call waiting, the incoming call is forwarded to the specified phone number if you reject or ignore the second incoming call.
No Answer Forward to Number	Select this if you want the ZyXEL Device to forward incoming calls to the specified phone number if the call is unanswered. (See **No Answer Waiting Time**.) Specify the phone number in the field on the right.
No Answer Waiting Time	This field is used by the **No Answer Forward to Number** feature and **No Answer** conditions below. Enter the number of seconds the ZyXEL Device should wait for you to answer an incoming call before it considers the call is unanswered.
Advanced Setup	The ZyXEL Device checks these rules before it checks the rules in the **Forward to Number** section.
#	This field is a sequential value, and it is not associated with a specific rule. The sequence is important, however. The ZyXEL Device checks each rule in order, and it only follows the first one that applies.
Activate	Select this to enable this rule. Clear this to disable this rule.
Incoming Call Number	Enter the phone number to which this rule applies.
Forward to Number	Enter the phone number to which you want to forward incoming calls from the **Incoming Call Number**. You may leave this field blank, depending on the **Condition**.
Condition	Select the situations in which you want to forward incoming calls from the **Incoming Call Number**, or select an alternative action. **Unconditional** - The ZyXEL Device immediately forwards any calls from the **Incoming Call Number** to the **Forward to Number**. **Busy -** The ZyXEL Device forwards any calls from the **Incoming Call Number** to the **Forward to Number** when your SIP account already has a call connected. **No Answer -** The ZyXEL Device forwards any calls from the **Incoming Call Number** to the **Forward to Number** when the call is unanswered. (See **No Answer Waiting Time**.) **Block -** The ZyXEL Device rejects calls from the **Incoming Call Number**. **Accept -** The ZyXEL Device allows calls from the **Incoming Call Number**. You might create a rule with this condition if you do not want incoming calls from someone to be forwarded by rules in the **Forward to Number** section.
Apply	Click this to save your changes and to apply them to the ZyXEL Device.
Cancel	Click this to set every field in this screen to its last-saved value.

10.15 PSTN Line (“L” models only)

With PSTN line you can make and receive regular PSTN phone calls. Use a prefix number to make a regular call. When the device does not have power, you can make regular calls without dialing a prefix number.

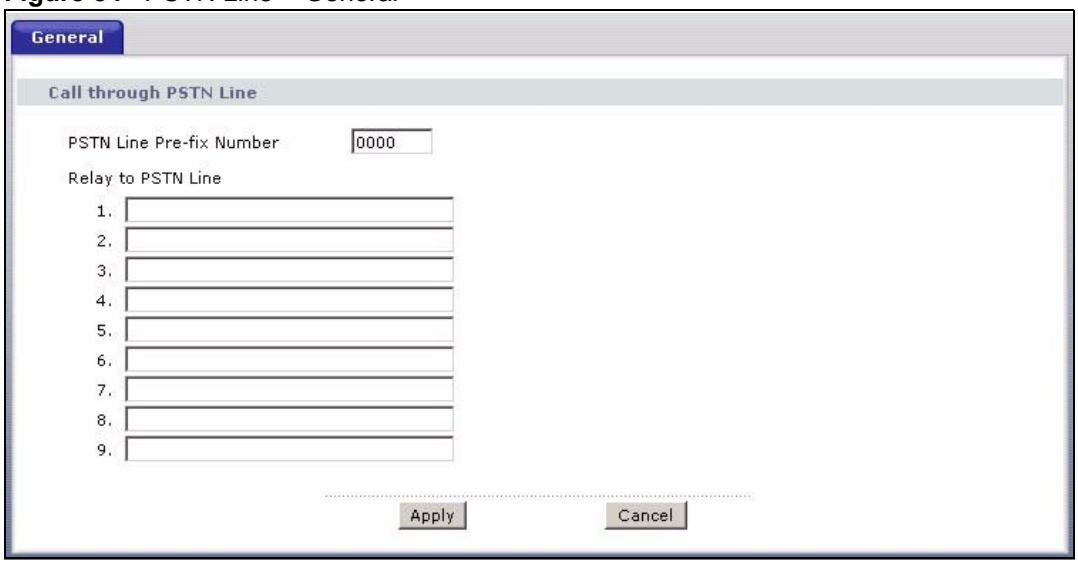
When the ZyXEL Device does not have power, the phone(s) connected to the **PHONE** port(s) can still be used for making PSTN calls. Only one phone can be in use at a time.

You can also use the **PSTN Line** screen to specify phone numbers that should always use the regular phone service (without having to dial a prefix number). Do this for emergency numbers (like those for contacting police, fire or emergency medical services).

10.16 PSTN Line Screen (“L” models only)

Use this screen to set up the PSTN line you use to make regular phone calls. To access this screen, click **VoIP > PSTN Line > General**.

Figure 84 PSTN Line > General



Each field is described in the following table.

Table 59 PSTN Line > General

LABEL	DESCRIPTION
PSTN Line Pre-fix Number	Enter a prefix (one to seven numbers) you dial before you dial the phone number, if you want to make a regular phone call while one of your SIP accounts is registered. These numbers tell the ZyXEL Device that you want to make a regular phone call.
Relay to PSTN Line	Enter phone numbers (for regular calls, not VoIP calls) that you want to dial without the prefix number. For example, you should enter emergency numbers. The number (1 - 9) is not a speed-dial number. It is just a sequential value that is not associated with any phone number.
Apply	Click this to save your changes and to apply them to the ZyXEL Device.
Cancel	Click this to set every field in this screen to its last-saved value.

11

Firewalls

Use these screens to enable and configure the firewall that protects your ZyXEL Device and your LAN from unwanted or malicious traffic.

11.1 Firewall Overview

Originally, the term *firewall* referred to a construction technique designed to prevent the spread of fire from one room to another. The networking term "firewall" is a system or group of systems that enforces an access-control policy between two networks. It may also be defined as a mechanism used to protect a trusted network from an untrusted network. Of course, firewalls cannot solve every security problem. A firewall is one of the mechanisms used to establish a network security perimeter in support of a network security policy. It should never be the only mechanism or method employed. For a firewall to guard effectively, you must design and deploy it appropriately. This requires integrating the firewall into a broad information-security policy. In addition, specific policies must be implemented within the firewall itself.

11.1.1 Stateful Inspection Firewall

Stateful inspection firewalls restrict access by screening data packets against defined access rules. They make access control decisions based on IP address and protocol. They also "inspect" the session data to assure the integrity of the connection and to adapt to dynamic protocols. These firewalls generally provide the best speed and transparency; however, they may lack the granular application level access control or caching that some proxies support. Firewalls, of one type or another, have become an integral part of standard security solutions for enterprises.

11.1.2 About the ZyXEL Device Firewall

The ZyXEL Device firewall is a stateful inspection firewall and is designed to protect against Denial of Service attacks when activated. The ZyXEL Device's purpose is to allow a private Local Area Network (LAN) to be securely connected to the Internet. The ZyXEL Device can be used to prevent theft, destruction and modification of data, as well as log events, which may be important to the security of your network.

The ZyXEL Device is installed between the LAN and the Internet. This allows it to act as a secure gateway for all data passing between the Internet and the LAN.

Enable the firewall to protect your LAN computers from attacks by hackers on the Internet and control access between the LAN and WAN. By default the firewall:

- allows traffic that originates from your LAN computers to go to all of the networks.
- blocks traffic that originates on the other networks from going to the LAN.

Your customized rules take precedence and override the ZyXEL Device's default settings. The ZyXEL Device checks the source IP address, destination IP address and IP protocol type of network traffic against the firewall rules (in the order you list them). When the traffic matches a rule, the ZyXEL Device takes the action specified in the rule.

11.1.3 Guidelines For Enhancing Security With Your Firewall

1. Change the default password via web configurator.
2. Think about access control before you connect to the network in any way.
3. Limit who can access your router.
4. Don't enable any local service (such as telnet or FTP) that you don't use. Any enabled service could present a potential security risk. A determined hacker might be able to find creative ways to misuse the enabled services to access the firewall or the network.
5. For local services that are enabled, protect against misuse. Protect by configuring the services to communicate only with specific peers, and protect by configuring rules to block packets for the services at specific interfaces.
6. Protect against IP spoofing by making sure the firewall is active.
7. Keep the firewall in a secured (locked) room.

11.2 General Firewall Policy Overview

Firewall rules are grouped based on the direction of travel of packets to which they apply.

- LAN to LAN/ Router
- LAN to WAN
- WAN to LAN
- WAN to WAN/ Router

The LAN includes both the LAN port and the WLAN.

By default, the ZyXEL Device's stateful packet inspection allows packets traveling in the following directions:

- LAN to LAN/ Router
  These rules specify which computers on the LAN can manage the ZyXEL Device (remote management) and communicate between networks or subnets connected to the LAN interface (IP alias).

You can also configure the remote management settings to allow only a specific computer to manage the ZyXEL Device.

- LAN to WAN
  These rules specify which computers on the LAN can access which computers or services on the WAN.

By default, the ZyXEL Device's stateful packet inspection drops packets traveling in the following directions:

- WAN to LAN
  These rules specify which computers on the WAN can access which computers or services on the LAN.

You also need to configure NAT port forwarding (or full featured NAT address mapping rules) to allow computers on the WAN to access devices on the LAN.

- WAN to WAN/ Router
  By default the ZyXEL Device stops computers on the WAN from managing the ZyXEL Device or using the ZyXEL Device as a gateway to communicate with other computers on the WAN. You could configure one of these rules to allow a WAN computer to manage the ZyXEL Device.

You also need to configure the remote management settings to allow a WAN computer to manage the ZyXEL Device.

You may define additional rules and sets or modify existing ones but please exercise extreme caution in doing so.

For example, you may create rules to:

- Block certain types of traffic, such as IRC (Internet Relay Chat), from the LAN to the Internet.
- Allow certain types of traffic, such as Lotus Notes database synchronization, from specific hosts on the Internet to specific hosts on the LAN.
- Allow everyone except your competitors to access a web server.
- Restrict use of certain protocols, such as Telnet, to authorized users on the LAN.

These custom rules work by comparing the source IP address, destination IP address and IP protocol type of network traffic to rules set by the administrator. Your customized rules take precedence and override the ZyXEL Device's default rules.

11.3 Security Considerations

Incorrectly configuring the firewall may block valid access or introduce security risks to the ZyXEL Device and your protected network. Use caution when creating or deleting firewall rules and test your rules after you configure them.

Consider these security ramifications before creating a rule:

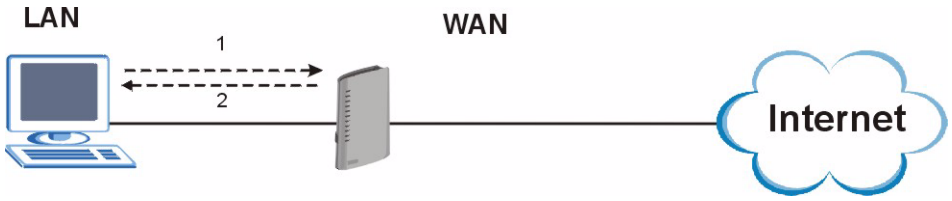
1. Does this rule stop LAN users from accessing critical resources on the Internet? For example, if IRC is blocked, are there users that require this service?
2. Is it possible to modify the rule to be more specific? For example, if IRC is blocked for all users, will a rule that blocks just certain users be more effective?
3. Does a rule that allows Internet users access to resources on the LAN create a security vulnerability? For example, if FTP ports (TCP 20, 21) are allowed from the Internet to the LAN, Internet users may be able to connect to computers with running FTP servers.
4. Does this rule conflict with any existing rules?

Once these questions have been answered, adding rules is simply a matter of entering the information into the correct fields in the web configurator screens..

11.4 Triangle Route

When the firewall is on, your ZyXEL Device acts as a secure gateway between your LAN and the Internet. In an ideal network topology, all incoming and outgoing network traffic passes through the ZyXEL Device to protect your LAN against attacks.

Figure 85 Ideal Firewall Setup



11.4.1 The “Triangle Route” Problem

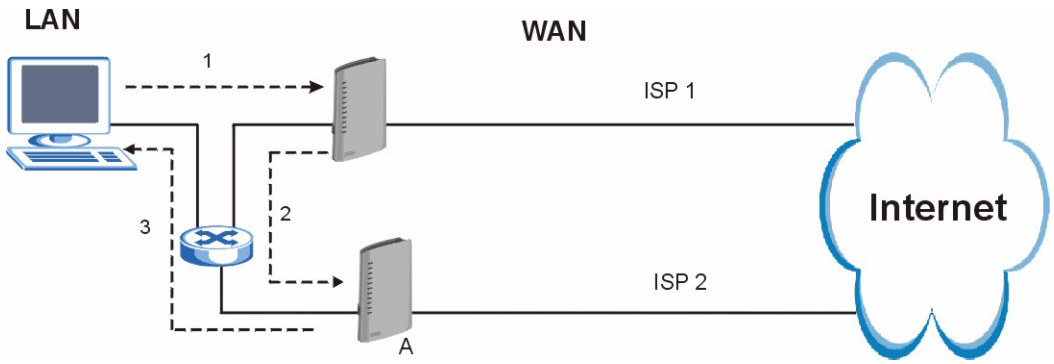
A traffic route is a path for sending or receiving data packets between two Ethernet devices. You may have more than one connection to the Internet (through one or more ISPs). If an alternate gateway is on the LAN (and its IP address is in the same subnet as the ZyXEL Device’s LAN IP address), the “triangle route” (also called asymmetrical route) problem may occur. The steps below describe the “triangle route” problem.

1. A computer on the LAN initiates a connection by sending out a SYN packet to a receiving server on the WAN.

2 The ZyXEL Device reroutes the SYN packet through Gateway **A** on the LAN to the WAN.
3 The reply from the WAN goes directly to the computer on the LAN without going through the ZyXEL Device.

As a result, the ZyXEL Device resets the connection, as the connection has not been acknowledged.

Figure 86 "Triangle Route" Problem



11.4.2 Solving the "Triangle Route" Problem

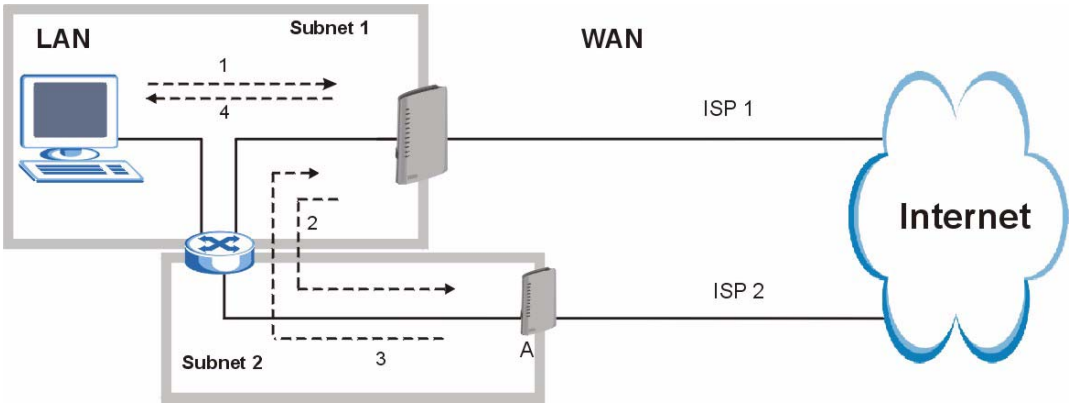
If you have the ZyXEL Device allow triangle route sessions, traffic from the WAN can go directly to a LAN computer without passing through the ZyXEL Device and its firewall protection.

Another solution is to use IP alias. IP alias allows you to partition your network into logical sections over the same Ethernet interface. Your ZyXEL Device supports up to three logical LAN interfaces with the ZyXEL Device being the gateway for each logical network.

It's like having multiple LAN networks that actually use the same physical cables and ports. By putting your LAN and Gateway **A** in different subnets, all returning network traffic must pass through the ZyXEL Device to your LAN. The following steps describe such a scenario.

1 A computer on the LAN initiates a connection by sending a SYN packet to a receiving server on the WAN.
2 The ZyXEL Device reroutes the packet to Gateway A, which is in Subnet 2.
3 The reply from the WAN goes to the ZyXEL Device.
4 The ZyXEL Device then sends it to the computer on the LAN in Subnet 1.

Figure 87 IP Alias

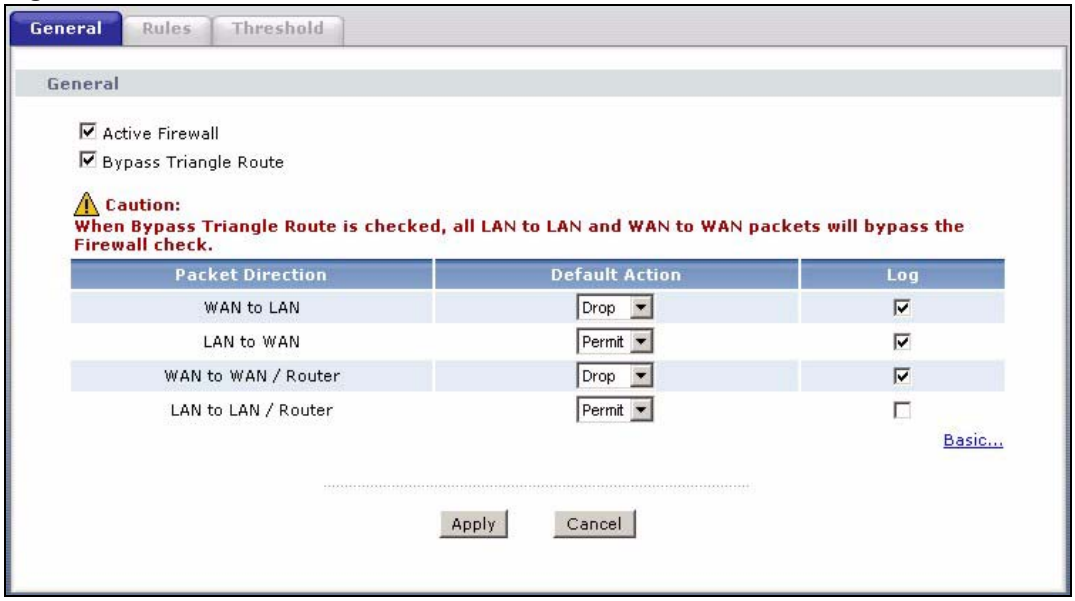


11.5 General Firewall Policy

Click **Security > Firewall** to display the following screen. Activate the firewall by selecting the **Active Firewall** check box as seen in the following screen.

Refer to Section 11.5 on page 160 for more information.

Figure 88 Firewall: General



The following table describes the labels in this screen.

Table 60 Firewall: General

LABEL	DESCRIPTION
Active Firewall	Select this check box to activate the firewall. The ZyXEL Device performs access control and protects against Denial of Service (DoS) attacks when the firewall is activated.
Bypass Triangle Route	If an alternate gateway on the LAN has an IP address in the same subnet as the ZyXEL Device's LAN IP address, return traffic may not go through the ZyXEL Device. This is called an asymmetrical or "triangle" route. This causes the ZyXEL Device to reset the connection, as the connection has not been acknowledged. Select this check box to have the ZyXEL Device permit the use of asymmetrical route topology on the network (not reset the connection). Note: Allowing asymmetrical routes may let traffic from the WAN go directly to the LAN without passing through the ZyXEL Device. A better solution is to use IP alias to put the ZyXEL Device and the backup gateway on separate subnets. See Section 11.4.1 on page 158 for an example.
Packet Direction	This is the direction of travel of packets (**LAN to LAN / Router**, **LAN to WAN**, **WAN to WAN / Router**, **WAN to LAN**). Firewall rules are grouped based on the direction of travel of packets to which they apply. For example, **LAN to LAN / Router** means packets traveling from a computer/subnet on the LAN to either another computer/subnet on the LAN interface of the ZyXEL Device or the ZyXEL Device itself.
Default Action	Use the drop-down list boxes to select the default action that the firewall is take on packets that are traveling in the selected direction and do not match any of the firewall rules. Select **Drop** to silently discard the packets without sending a TCP reset packet or an ICMP destination-unreachable message to the sender. Select **Reject** to deny the packets and send a TCP reset packet (for a TCP packet) or an ICMP destination-unreachable message (for a UDP packet) to the sender. Select **Permit** to allow the passage of the packets.
Log	Select the check box to create a log (when the above action is taken) for packets that are traveling in the selected direction and do not match any of your customized rules.
Expand...	Click this button to display more information.
Basic...	Click this button to display less information.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

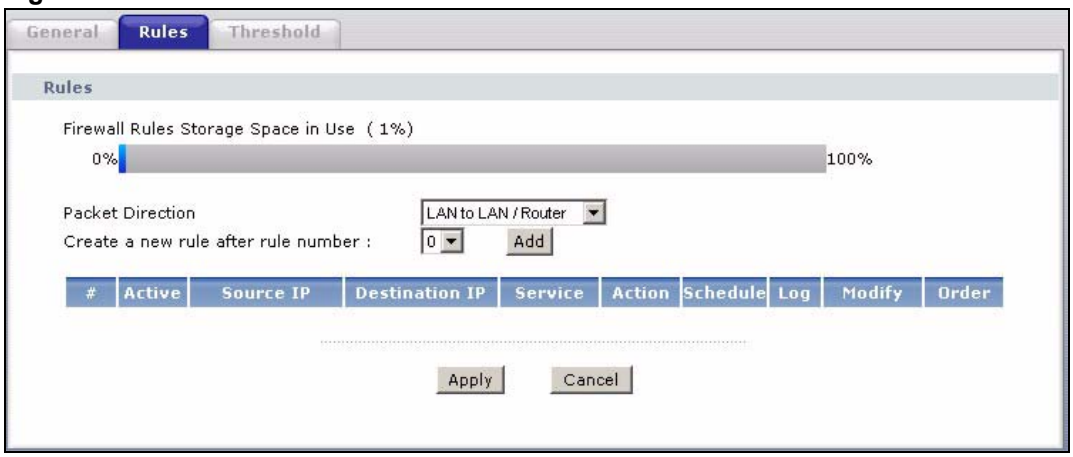
11.6 Firewall Rules Summary

The ordering of your rules is very important as rules are applied in turn.

Refer to Section 11.5 on page 160 for more information.

Click **Security > Firewall > Rules** to bring up the following screen. This screen displays a list of the configured firewall rules. Note the order in which the rules are listed.

Figure 89 Firewall Rules



The following table describes the labels in this screen.

Table 61 Firewall Rules

LABEL	DESCRIPTION
Firewall Rules Storage Space in Use	This read-only bar shows how much of the ZyXEL Device's memory for recording firewall rules it is currently using. When you are using 80% or less of the storage space, the bar is green. When the amount of space used is over 80%, the bar is red.
Packet Direction	Use the drop-down list box to select a direction of travel of packets for which you want to configure firewall rules.
Create a new rule after rule number	Select an index number and click **Add** to add a new firewall rule after the selected index number. For example, if you select “6”, your new rule becomes number 7 and the previous rule 7 (if there is one) becomes rule 8.
	The following read-only fields summarize the rules you have created that apply to traffic traveling in the selected packet direction. The firewall rules that you configure (summarized below) take priority over the general firewall action settings in the **General** screen.
#	This is your firewall rule number. The ordering of your rules is important as rules are applied in turn.
Active	This field displays whether a firewall is turned on or not. Select the check box to enable the rule. Clear the check box to disable the rule.
Source IP	This drop-down list box displays the source addresses or ranges of addresses to which this firewall rule applies. Please note that a blank source or destination address is equivalent to **Any**.
Destination IP	This drop-down list box displays the destination addresses or ranges of addresses to which this firewall rule applies. Please note that a blank source or destination address is equivalent to **Any**.
Service	This drop-down list box displays the services to which this firewall rule applies. See Appendix E on page 373 for more information.
Action	This field displays whether the firewall silently discards packets (**Drop**), discards packets and sends a TCP reset packet or an ICMP destination-unreachable message to the sender (**Reject**) or allows the passage of packets (**Permit**).
Schedule	This field tells you whether a schedule is specified (**Yes**) or not (**No**).
Log	This field shows you whether a log is created when packets match this rule (**Yes**) or not (**No**).

Table 61 Firewall Rules (continued)

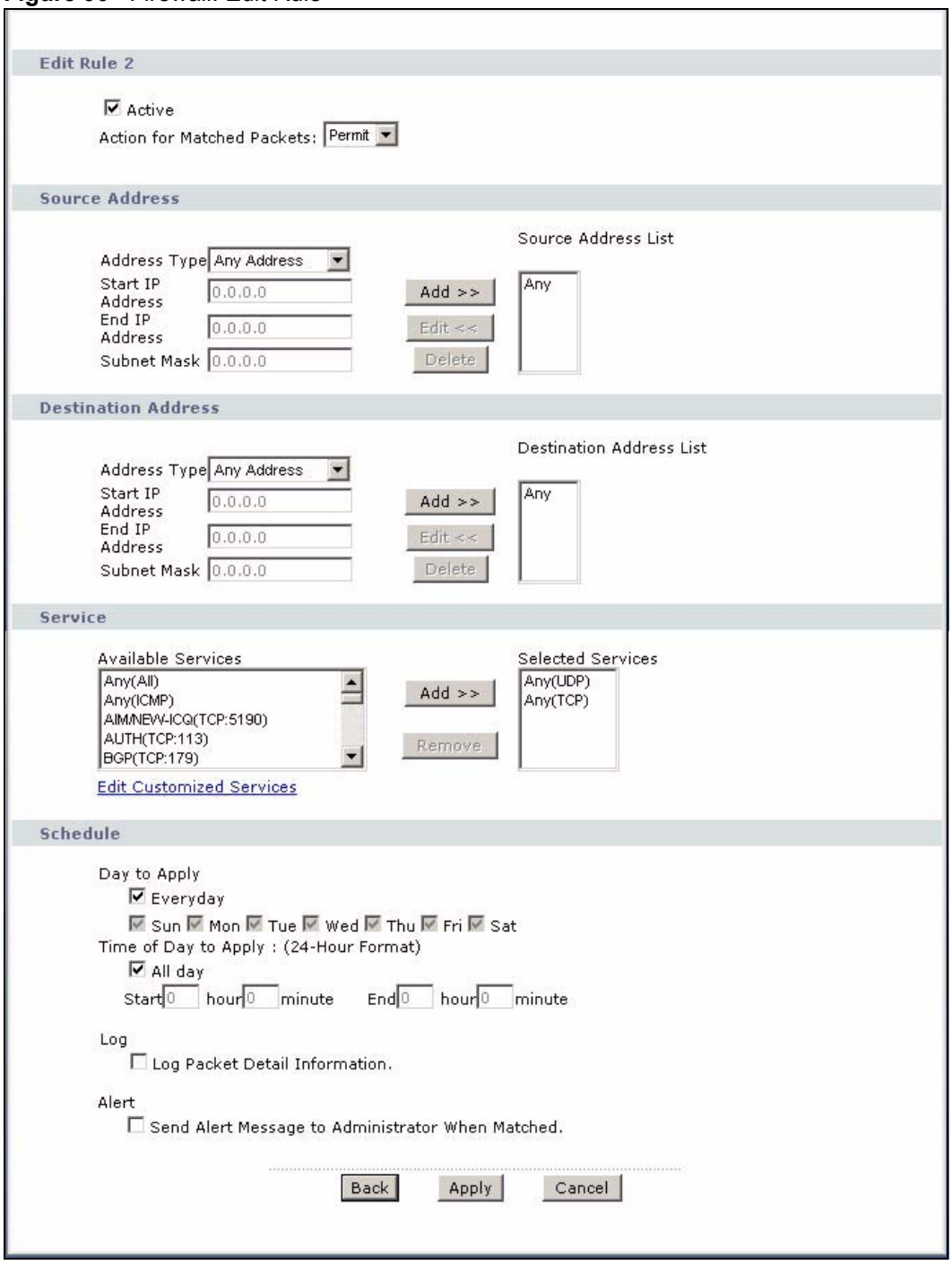
LABEL	DESCRIPTION
Modify	Click the Edit icon to go to the screen where you can edit the rule. Click the Remove icon to delete an existing firewall rule. A window displays asking you to confirm that you want to delete the firewall rule. Note that subsequent firewall rules move up by one when you take this action.
Order	Click the Move icon to display the **Move the rule to** field. Type a number in the **Move the rule to** field and click the **Move** button to move the rule to the number that you typed. The ordering of your rules is important as they are applied in order of their numbering.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

11.6.1 Configuring Firewall Rules

Refer to Section 11.5 on page 160 for more information.

In the **Rules** screen, select an index number and click **Add** or click a rule's **Edit** icon to display this screen and refer to the following table for information on the labels.

Figure 90 Firewall: Edit Rule



The following table describes the labels in this screen.

Table 62 Firewall: Edit Rule

LABEL	DESCRIPTION
Active	Select this option to enable this firewall rule.
Action for Matched Packet	Use the drop-down list box to select whether to discard (**Drop**), deny and send an ICMP destination-unreachable message to the sender of (**Reject**) or allow the passage of (**Permit**) packets that match this rule.

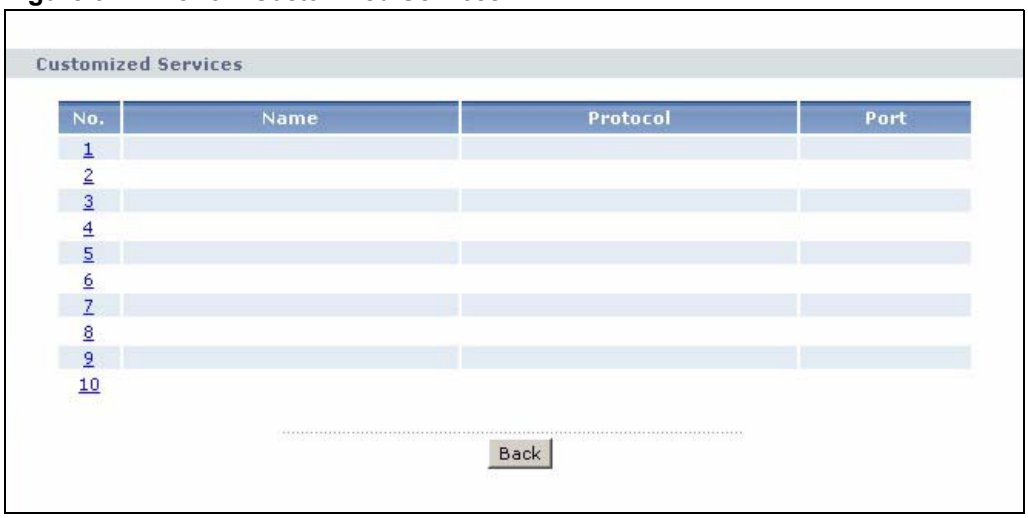
Table 62 Firewall: Edit Rule (continued)

LABEL	DESCRIPTION
Source/Destination Address	
Address Type	Do you want your rule to apply to packets with a particular (single) IP, a range of IP addresses (for instance, 192.168.1.10 to 192.169.1.50), a subnet or any IP address? Select an option from the drop-down list box that includes: **Single Address**, **Range Address**, **Subnet Address** and **Any Address**.
Start IP Address	Enter the single IP address or the starting IP address in a range here.
End IP Address	Enter the ending IP address in a range here.
Subnet Mask	Enter the subnet mask here, if applicable.
Add >>	Click **Add >>** to add a new address to the **Source** or **Destination Address** box. You can add multiple addresses, ranges of addresses, and/or subnets.
Edit <<	To edit an existing source or destination address, select it from the box and click **Edit <<**.
Delete	Highlight an existing source or destination address from the **Source** or **Destination Address** box above and click **Delete** to remove it.
Services	
Available/ Selected Services	Please see Appendix E on page 373 for more information on services available. Highlight a service from the **Available Services** box on the left, then click **Add >>** to add it to the **Selected Services** box on the right. To remove a service, highlight it in the **Selected Services** box on the right, then click **Remove**.
Edit Customized Service	Click the **Edit Customized Services** link to bring up the screen that you use to configure a new custom service that is not in the predefined list of services.
Schedule	
Day to Apply	Select everyday or the day(s) of the week to apply the rule.
Time of Day to Apply (24-Hour Format)	Select **All Day** or enter the start and end times in the hour-minute format to apply the rule.
Log	
Log Packet Detail Information	This field determines if a log for packets that match the rule is created or not. Go to the **Log Settings** page and select the **Access Control** logs category to have the ZyXEL Device record these logs.
Alert	
Send Alert Message to Administrator When Matched	Select the check box to have the ZyXEL Device generate an alert when the rule is matched.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to exit this screen without saving.

11.6.2 Customized Services

Configure customized services and port numbers not predefined by the ZyXEL Device. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) website. See Appendix E on page 373 for some examples. Click the **Edit Customized Services** link while editing a firewall rule to configure a custom service port. This displays the following screen.

Figure 91 Firewall: Customized Services



The following table describes the labels in this screen.

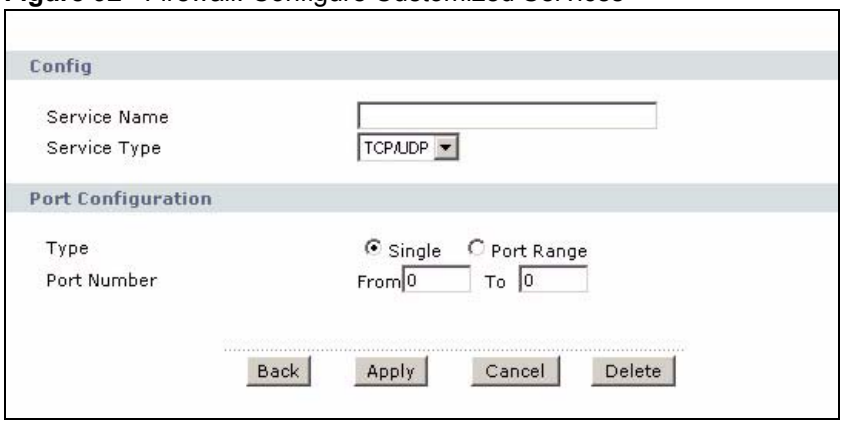
Table 63 Customized Services

LABEL	DESCRIPTION
No.	This is the number of your customized port. Click a rule's number of a service to go to the **Firewall Customized Services Config** screen to configure or edit a customized service.
Name	This is the name of your customized service.
Protocol	This shows the IP protocol (**TCP**, **UDP** or **TCP/UDP**) that defines your customized service.
Port	This is the port number or range that defines your customized service.
Back	Click **Back** to return to the **Firewall Edit Rule** screen.

11.6.3 Configuring A Customized Service

Click a rule number in the **Firewall Customized Services** screen to create a new custom port or edit an existing one. This action displays the following screen.

Figure 92 Firewall: Configure Customized Services



The following table describes the labels in this screen.

Table 64 Firewall: Configure Customized Services

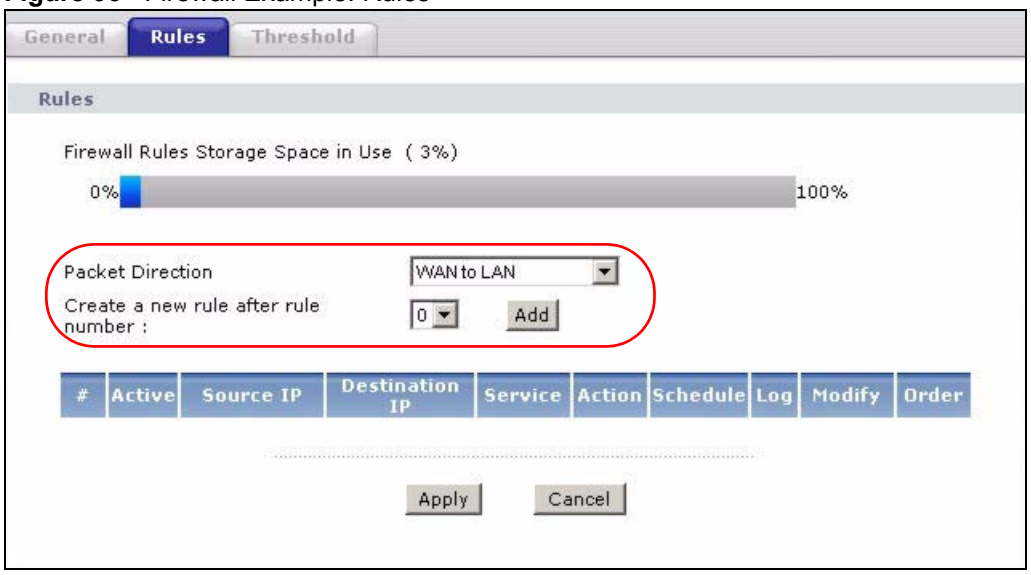
LABEL	DESCRIPTION
Service Name	Type a unique name for your custom port.
Service Type	Choose the IP port (**TCP**, **UDP** or **TCP/UDP**) that defines your customized port from the drop down list box.
Port Configuration	
Type	Click **Single** to specify one port only or **Range** to specify a span of ports that define your customized service.
Port Number	Type a single port number or the range of port numbers that define your customized service.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to return to the previously saved settings.
Delete	Click **Delete** to delete the current rule.

11.7 Example Firewall Rule

The following Internet firewall rule example allows a hypothetical “MyService” connection from the Internet.

1. Click **Security > Firewall** > **Rules**.
2. Select **WAN to LAN** in the **Packet Direction** field.

Figure 93 Firewall Example: Rules



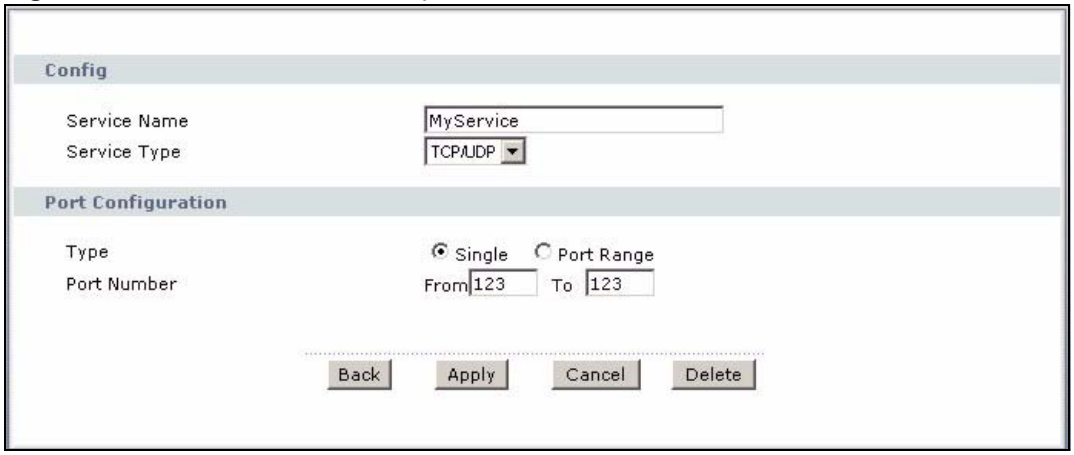
3 In the **Rules** screen, select the index number after that you want to add the rule. For example, if you select "6", your new rule becomes number 7 and the previous rule 7 (if there is one) becomes rule 8.

4 Click **Add** to display the firewall rule configuration screen.

5 In the **Edit Rule** screen, click the **Edit Customized Services** link to open the **Customized Service** screen.

6 Click an index number to display the **Customized Services Config** screen and configure the screen as follows and click **Apply**.

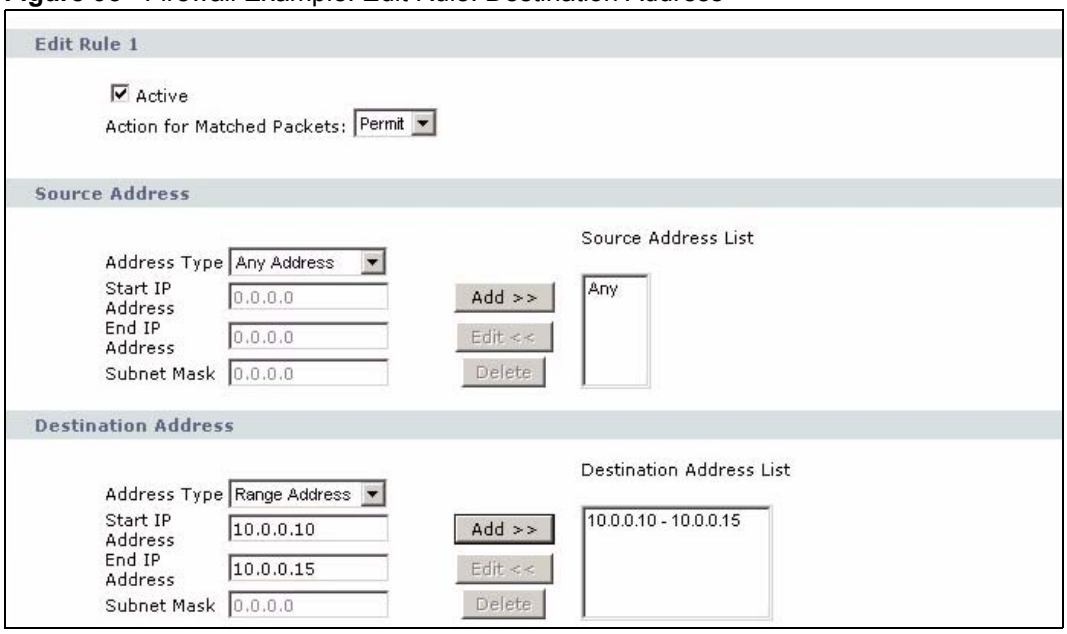
Figure 94 Edit Custom Port Example



7 Select **Any** in the **Destination Address List** box and then click **Delete**.

8 Configure the destination address screen as follows and click **Add**.

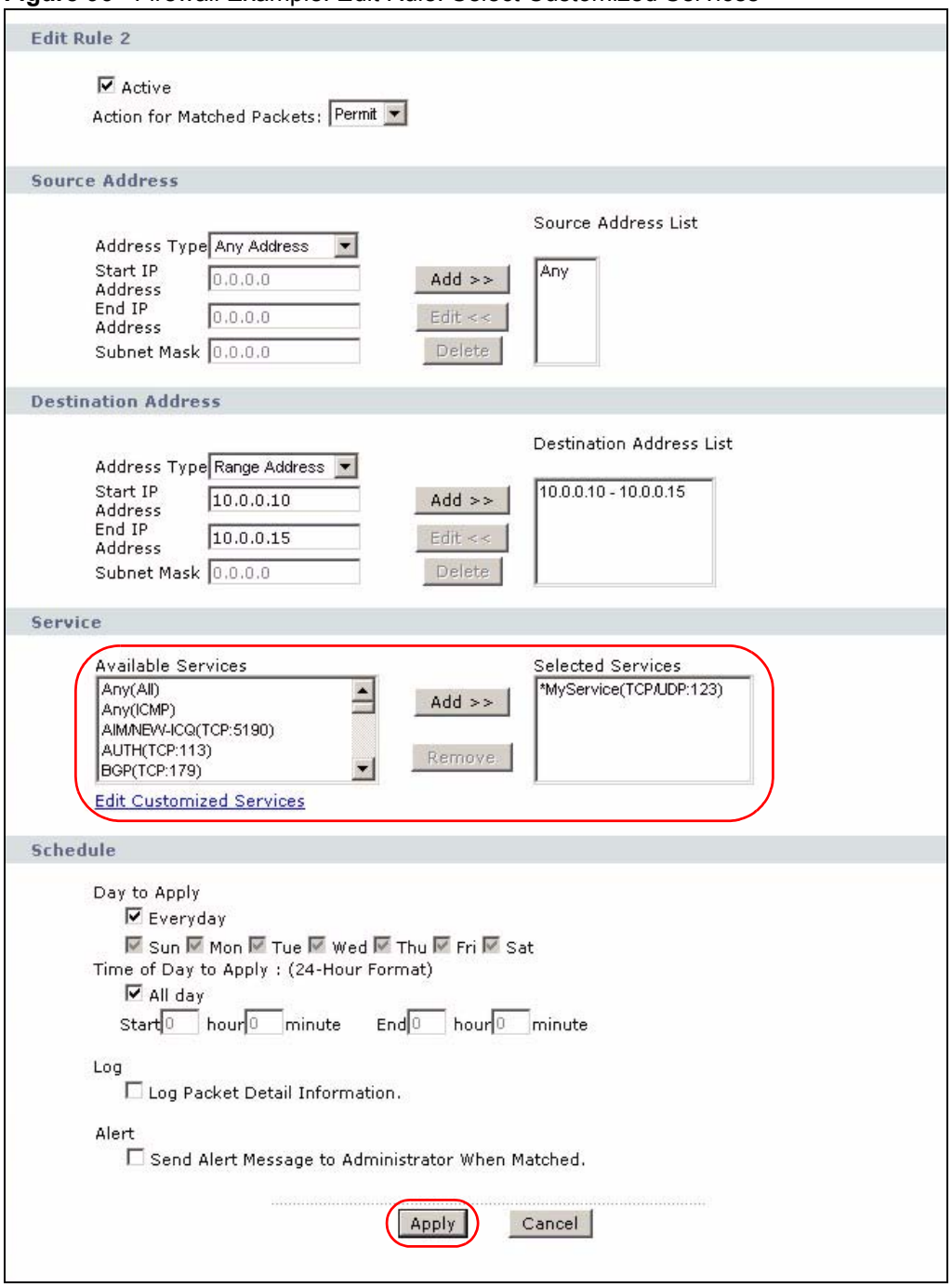
Figure 95 Firewall Example: Edit Rule: Destination Address



9 Use the **Add >>** and **Remove** buttons between **Available Services** and **Selected Services** list boxes to configure it as follows. Click **Apply** when you are done.

Custom services show up with an "*" before their names in the **Services** list box and the **Rules** list box.

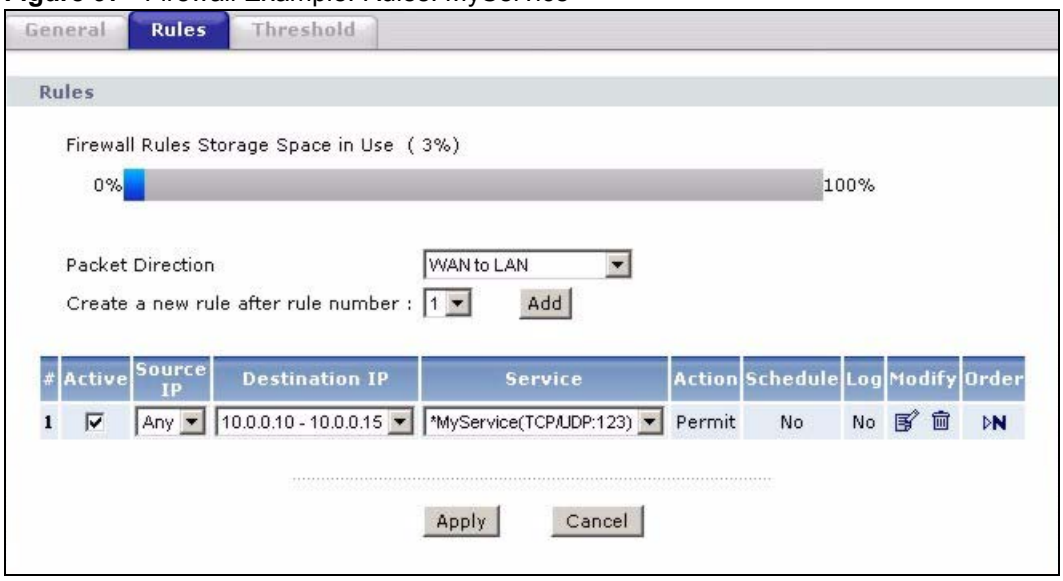
Figure 96 Firewall Example: Edit Rule: Select Customized Services



On completing the configuration procedure for this Internet firewall rule, the **Rules** screen should look like the following.

Rule 1 allows a “MyService” connection from the WAN to IP addresses 10.0.0.10 through 10.0.0.15 on the LAN.

Figure 97 Firewall Example: Rules: MyService

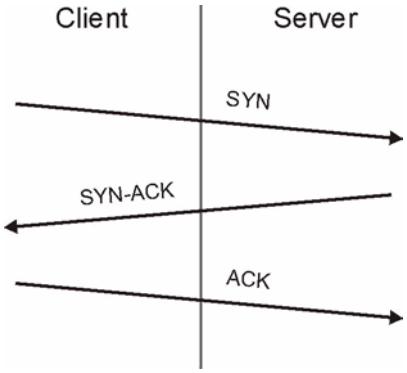


11.8 Firewall Thresholds

For DoS attacks, the ZyXEL Device uses thresholds to determine when to start dropping sessions that do not become fully established (half-open sessions). These thresholds apply globally to all sessions.

For TCP, half-open means that the session has not reached the established state-the TCP three-way handshake has not yet been completed. Under normal circumstances, the application that initiates a session sends a SYN (synchronize) packet to the receiving server. The receiver sends back an ACK (acknowledgment) packet and its own SYN, and then the initiator responds with an ACK (acknowledgment). After this handshake, a connection is established.

Figure 98 Three-Way Handshake



For UDP, half-open means that the firewall has detected no return traffic. An unusually high number (or arrival rate) of half-open sessions could indicate a DOS attack.

11.8.1 Threshold Values

If everything is working properly, you probably do not need to change the threshold settings as the default threshold values should work for most small offices. Tune these parameters when you believe the ZyXEL Device has been receiving DoS attacks that are not recorded in the logs or the logs show that the ZyXEL Device is classifying normal traffic as DoS attacks. Factors influencing choices for threshold values are:

1. The maximum number of opened sessions.
2. The minimum capacity of server backlog in your LAN network.
3. The CPU power of servers in your LAN network.
4. Network bandwidth.
5. Type of traffic for certain servers.

Reduce the threshold values if your network is slower than average for any of these factors (especially if you have servers that are slow or handle many tasks and are often busy).

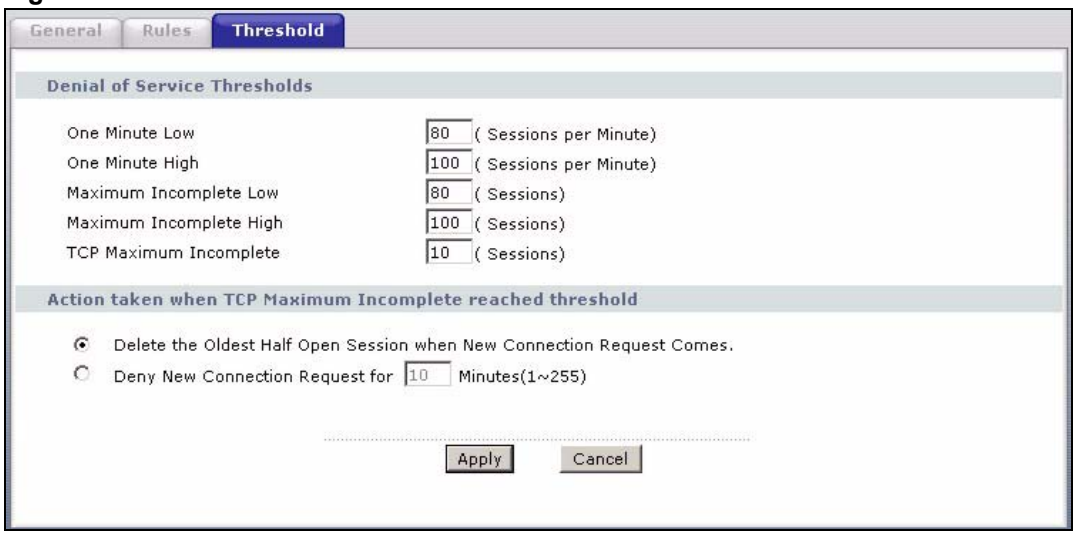
- If you often use P2P applications such as file sharing with eMule or eDonkey, it's recommended that you increase the threshold values since lots of sessions will be established during a small period of time and the ZyXEL Device may classify them as DoS attacks.

11.8.2 Configuring Firewall Thresholds

The ZyXEL Device also sends alerts whenever **TCP Maximum Incomplete** is exceeded. The global values specified for the threshold and timeout apply to all TCP connections.

Click **Firewall** > **Threshold** to bring up the next screen.

Figure 99 Firewall: Threshold



The following table describes the labels in this screen.

Table 65 Firewall: Threshold

LABEL	DESCRIPTION
Denial of Service Thresholds	The ZyXEL Device measures both the total number of existing half-open sessions and the rate of session establishment attempts. Both TCP and UDP half-open sessions are counted in the total number and rate measurements. Measurements are made once a minute.
One Minute Low	This is the rate of new half-open sessions per minute that causes the firewall to stop deleting half-open sessions. The ZyXEL Device continues to delete half-open sessions as necessary, until the rate of new connection attempts drops below this number.
One Minute High	This is the rate of new half-open sessions per minute that causes the firewall to start deleting half-open sessions. When the rate of new connection attempts rises above this number, the ZyXEL Device deletes half-open sessions as required to accommodate new connection attempts. For example, if you set the one minute high to 100, the ZyXEL Device starts deleting half-open sessions when more than 100 session establishment attempts have been detected in the last minute. It stops deleting half-open sessions when the number of session establishment attempts detected in a minute goes below the number set as the one minute low.
Maximum Incomplete Low	This is the number of existing half-open sessions that causes the firewall to stop deleting half-open sessions. The ZyXEL Device continues to delete half-open requests as necessary, until the number of existing half-open sessions drops below this number.
Maximum Incomplete High	This is the number of existing half-open sessions that causes the firewall to start deleting half-open sessions. When the number of existing half-open sessions rises above this number, the ZyXEL Device deletes half-open sessions as required to accommodate new connection requests. Do not set **Maximum Incomplete High** to lower than the current **Maximum Incomplete Low** number. For example, if you set the maximum incomplete high to 100, the ZyXEL Device starts deleting half-open sessions when the number of existing half-open sessions rises above 100. It stops deleting half-open sessions when the number of existing half-open sessions drops below the number set as the maximum incomplete low.
TCP Maximum Incomplete	An unusually high number of half-open sessions with the same destination host address could indicate that a DoS attack is being launched against the host. Specify the number of existing half-open TCP sessions with the same destination host IP address that causes the firewall to start dropping half-open sessions to that same destination host IP address. Enter a number between 1 and 256. As a general rule, you should choose a smaller number for a smaller network, a slower system or limited bandwidth. The ZyXEL Device sends alerts whenever the **TCP Maximum Incomplete** is exceeded.
Action taken when TCP Maximum Incomplete reached threshold	Select the action that ZyXEL Device should take when the TCP maximum incomplete threshold is reached. You can have the ZyXEL Device either: Delete the oldest half open session when a new connection request comes. or Deny new connection requests for the number of minutes that you specify (between 1 and 255).
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Reset	Click **Reset** to begin configuring this screen afresh.

12

Content Filtering

This chapter covers how to configure content filtering.

12.1 Content Filtering Overview

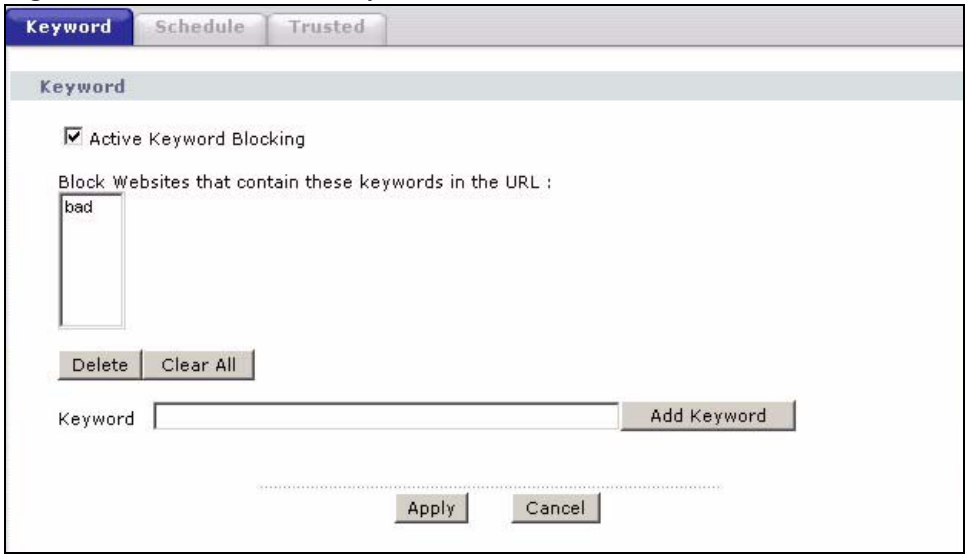
Internet content filtering allows you to create and enforce Internet access policies tailored to your needs. Content filtering gives you the ability to block web sites that contain key words (that you specify) in the URL. You can set a schedule for when the ZyXEL Device performs content filtering. You can also specify trusted IP addresses on the LAN for which the ZyXEL Device will not perform content filtering.

12.2 Configuring Keyword Blocking

Use this screen to block sites containing certain keywords in the URL. For example, if you enable the keyword "bad", the ZyXEL Device blocks all sites containing this keyword including the URL http://www.website.com/bad.html, even if it is not included in the Filter List.

To have your ZyXEL Device block Web sites containing keywords in their URLs, click **Security > Content Filter**. The screen appears as shown.

Figure 100 Content Filter: Keyword



The following table describes the labels in this screen.

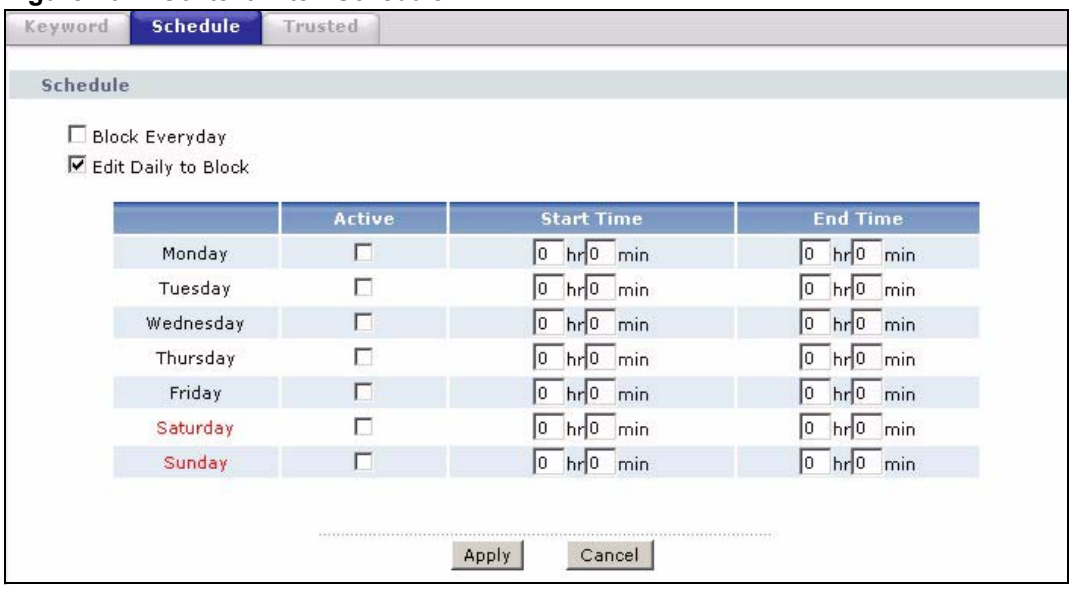
Table 66 Content Filter: Keyword

LABEL	DESCRIPTION
Active Keyword Blocking	Select this check box to enable this feature.
Block Websites that contain these keywords in the URL:	This box contains the list of all the keywords that you have configured the ZyXEL Device to block.
Delete	Highlight a keyword in the box and click **Delete** to remove it.
Clear All	Click **Clear All** to remove all of the keywords from the list.
Keyword	Type a keyword in this field. You may use any character (up to 127 characters). Wildcards are not allowed.
Add Keyword	Click **Add Keyword** after you have typed a keyword. Repeat this procedure to add other keywords. Up to 64 keywords are allowed. When you try to access a web page containing a keyword, you will get a message telling you that the content filter is blocking this request.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to return to the previously saved settings.

12.3 Configuring the Schedule

Use this screen to set the days and times for the ZyXEL Device to perform content filtering. Click **Security > Content Filter** > **Schedule**. The screen appears as shown.

Figure 101 Content Filter: Schedule



The following table describes the labels in this screen.

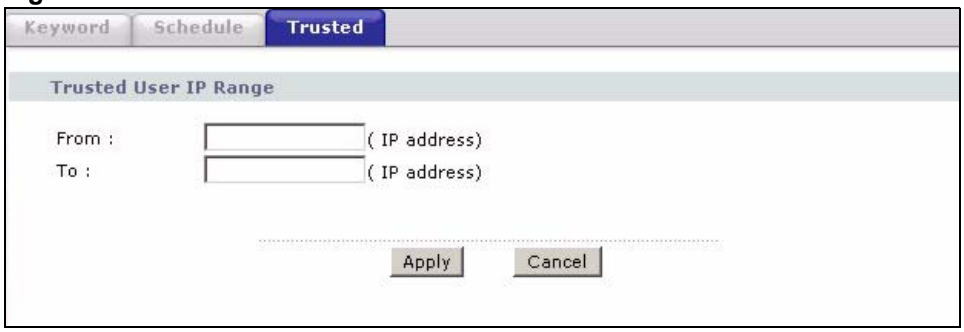
Table 67 Content Filter: Schedule

LABEL	DESCRIPTION
Schedule	Select **Block Everyday** to make the content filtering active everyday. Otherwise, select **Edit Daily to Block** and configure which days of the week (or everyday) and which time of the day you want the content filtering to be active.
Active	Select the check box to have the content filtering to be active on the selected day.
Start TIme	Enter the time when you want the content filtering to take effect in hour-minute format.
End Time	Enter the time when you want the content filtering to stop in hour-minute format.
Apply	Click **Apply** to save your changes.
Cancel	Click **Cancel** to return to the previously saved settings.

12.4 Configuring Trusted Computers

Use this screen to exclude a range of users on the LAN from content filtering on your ZyXEL Device. Click **Security > Content Filter** > **Trusted**. The screen appears as shown.

Figure 102 Content Filter: Trusted



The following table describes the labels in this screen.

Table 68 Content Filter: Trusted

LABEL	DESCRIPTION
Trusted User IP Range	
From	Type the IP address of a computer (or the beginning IP address of a specific range of computers) on the LAN that you want to exclude from content filtering.
To	Type the ending IP address of a specific range of users on your LAN that you want to exclude from content filtering. Leave this field blank if you want to exclude an individual computer.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to return to the previously saved settings.

13

Introduction to IPSec

This chapter introduces the basics of IPSec VPNs.

13.1 VPN Overview

A VPN (Virtual Private Network) provides secure communications between sites without the expense of leased site-to-site lines. A secure VPN is a combination of tunneling, encryption, authentication, access control and auditing technologies/services used to transport traffic over the Internet or any insecure network that uses the TCP/IP protocol suite for communication.

13.1.1 IPSec

Internet Protocol Security (IPSec) is a standards-based VPN that offers flexible solutions for secure data communications across a public network like the Internet. IPSec is built around a number of standardized cryptographic techniques to provide confidentiality, data integrity and authentication at the IP layer.

13.1.2 Security Association

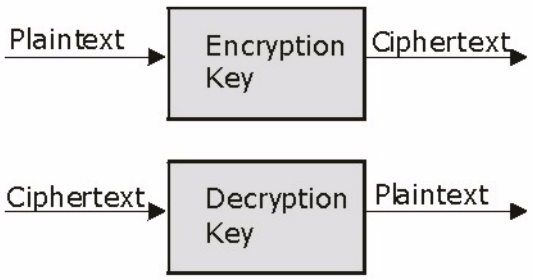
A Security Association (SA) is a contract between two parties indicating what security parameters, such as keys and algorithms they will use.

13.1.3 Other Terminology

13.1.3.1 Encryption

Encryption is a mathematical operation that transforms data from "plaintext" (readable) to "ciphertext" (scrambled text) using a "key". The key and clear text are processed by the encryption operation, which leads to the data scrambling that makes encryption secure. Decryption is the opposite of encryption: it is a mathematical operation that transforms “ciphertext” to plaintext. Decryption also requires a key.

Figure 103 Encryption and Decryption



13.1.3.2 Data Confidentiality

The IPSec sender can encrypt packets before transmitting them across a network.

13.1.3.3 Data Integrity

The IPSec receiver can validate packets sent by the IPSec sender to ensure that the data has not been altered during transmission.

13.1.3.4 Data Origin Authentication

The IPSec receiver can verify the source of IPSec packets. This service depends on the data integrity service.

13.1.4 VPN Applications

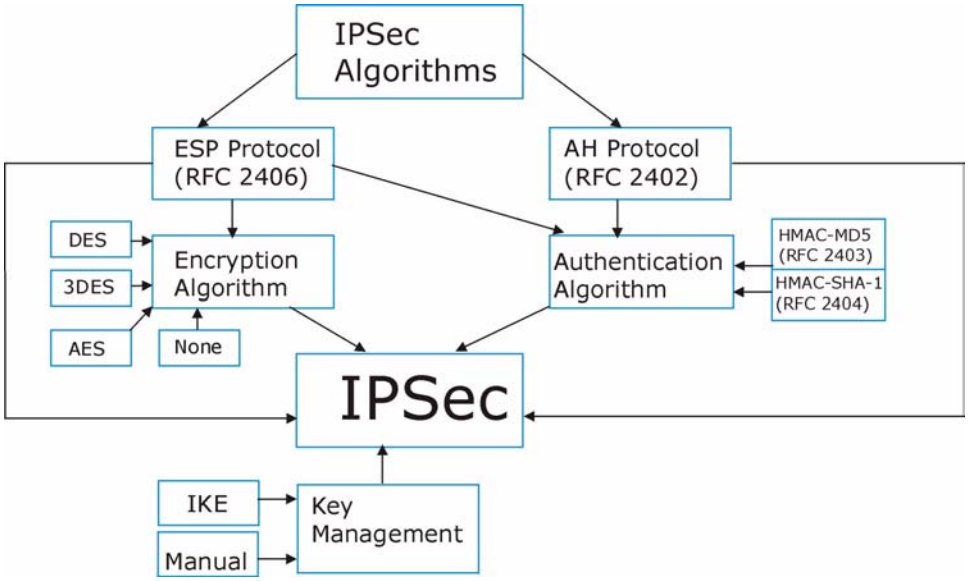
The ZyXEL Device supports the following VPN applications.

- Linking Two or More Private Networks Together
  Connect branch offices and business partners over the Internet with significant cost savings and improved performance when compared to leased lines between sites.
- Accessing Network Resources When NAT Is Enabled
  When NAT is enabled, remote users are not able to access hosts on the LAN unless the host is designated a public LAN server for that specific protocol. Since the VPN tunnel terminates inside the LAN, remote users will be able to access all computers that use private IP addresses on the LAN.
- Unsupported IP Applications
  A VPN tunnel may be created to add support for unsupported emerging IP applications.

13.2 IPSec Architecture

The overall IPSec architecture is shown as follows.

Figure 104 IPSec Architecture



13.2.1 IPSec Algorithms

The **ESP** (Encapsulating Security Payload) Protocol (RFC 2406) and **AH** (Authentication Header) protocol (RFC 2402) describe the packet formats and the default standards for packet structure (including implementation algorithms).

The Encryption Algorithm describes the use of encryption techniques such as DES (Data Encryption Standard) and Triple DES algorithms.

The Authentication Algorithms, HMAC-MD5 (RFC 2403) and HMAC-SHA-1 (RFC 2404, provide an authentication mechanism for the **AH** and **ESP** protocols. Please seeSection 14.2 on page 185for more information.

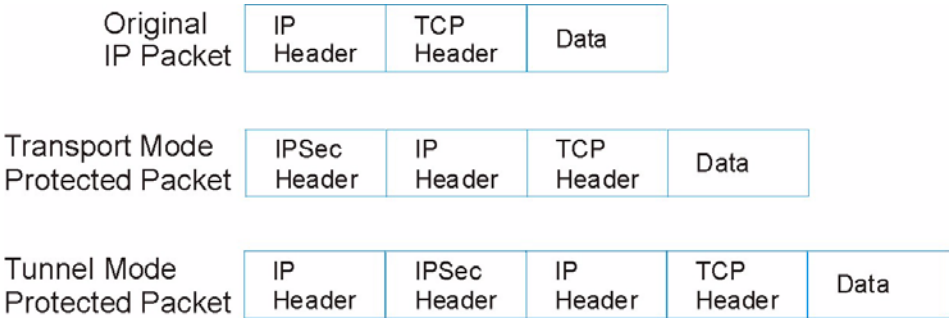
13.2.2 Key Management

Key management allows you to determine whether to use IKE (ISAKMP) or manual key configuration in order to set up a VPN.

13.3 Encapsulation

The two modes of operation for IPSec VPNs are **Transport** mode and **Tunnel** mode.

Figure 105 Transport and Tunnel Mode IPSec Encapsulation



13.3.1 Transport Mode

Transport mode is used to protect upper layer protocols and only affects the data in the IP packet. In **Transport** mode, the IP packet contains the security protocol (**AH** or **ESP**) located after the original IP header and options, but before any upper layer protocols contained in the packet (such as TCP and UDP).

With **ESP,** protection is applied only to the upper layer protocols contained in the packet. The IP header information and options are not used in the authentication process. Therefore, the originating IP address cannot be verified for integrity against the data.

With the use of **AH** as the security protocol, protection is extended forward into the IP header to verify the integrity of the entire packet by use of portions of the original IP header in the hashing process.

13.3.2 Tunnel Mode

Tunnel mode encapsulates the entire IP packet to transmit it securely. A **Tunnel** mode is required for gateway services to provide access to internal systems. **Tunnel** mode is fundamentally an IP tunnel with authentication and encryption. This is the most common mode of operation. **Tunnel** mode is required for gateway to gateway and host to gateway communications. **Tunnel** mode communications have two sets of IP headers:

- **Outside header**: The outside IP header contains the destination IP address of the VPN gateway.
- **Inside header**: The inside IP header contains the destination IP address of the final system behind the VPN gateway. The security protocol appears after the outer IP header and before the inside IP header.

13.4 IPSec and NAT

Read this section if you are running IPSec on a host computer behind the ZyXEL Device.

NAT is incompatible with the **AH** protocol in both **Transport** and **Tunnel** mode. An IPSec VPN using the **AH** protocol digitally signs the outbound packet, both data payload and headers, with a hash value appended to the packet. When using **AH** protocol, packet contents (the data payload) are not encrypted.

A NAT device in between the IPSec endpoints will rewrite either the source or destination address with one of its own choosing. The VPN device at the receiving end will verify the integrity of the incoming packet by computing its own hash value, and complain that the hash value appended to the received packet doesn't match. The VPN device at the receiving end doesn't know about the NAT in the middle, so it assumes that the data has been maliciously altered.

IPSec using **ESP** in **Tunnel** mode encapsulates the entire original packet (including headers) in a new IP packet. The new IP packet's source address is the outbound address of the sending VPN gateway, and its destination address is the inbound address of the VPN device at the receiving end. When using **ESP** protocol with authentication, the packet contents (in this case, the entire original packet) are encrypted. The encrypted contents, but not the new headers, are signed with a hash value appended to the packet.

Tunnel mode **ESP** with authentication is compatible with NAT because integrity checks are performed over the combination of the "original header plus original payload," which is unchanged by a NAT device.

Transport mode **ESP** with authentication is not compatible with NAT.

Table 69 VPN and NAT

SECURITY PROTOCOL	MODE	NAT
AH	Transport	N
AH	Tunnel	N
ESP	Transport	N
ESP	Tunnel	Y

14

VPN Screens

This chapter introduces the VPN screens. See Chapter 22 on page 289 for information on viewing logs and the appendix for IPSec log descriptions.

14.1 VPN/IPSec Overview

Use the screens documented in this chapter to configure rules for VPN connections and manage VPN connections.

14.2 IPSec Algorithms

The **ESP** and **AH** protocols are necessary to create a Security Association (SA), the foundation of an IPSec VPN. An SA is built from the authentication provided by the **AH** and **ESP** protocols. The primary function of key management is to establish and maintain the SA between systems. Once the SA is established, the transport of data may commence.

14.2.1 AH (Authentication Header) Protocol

AH protocol (RFC 2402) was designed for integrity, authentication, sequence integrity (replay resistance), and non-repudiation but not for confidentiality, for which the **ESP** was designed.

In applications where confidentiality is not required or not sanctioned by government encryption restrictions, an **AH** can be employed to ensure integrity. This type of implementation does not protect the information from dissemination but will allow for verification of the integrity of the information and authentication of the originator.

14.2.2 ESP (Encapsulating Security Payload) Protocol

The **ESP** protocol (RFC 2406) provides encryption as well as the services offered by **AH**. **ESP** authenticating properties are limited compared to the **AH** due to the non-inclusion of the IP header information during the authentication process. However, **ESP** is sufficient if only the upper layer protocols need to be authenticated.

An added feature of the **ESP** is payload padding, which further protects communications by concealing the size of the packet being transmitted.

Table 70 AH and ESP

	ESP	AH
ENCRYPTION		
	DES (default) Data Encryption Standard (DES) is a widely used method of data encryption using a private (secret) key. DES applies a 56-bit key to each 64-bit block of data.	**MD5** (default) MD5 (Message Digest 5) produces a 128-bit digest to authenticate packet data.
	3DES Triple DES (3DES) is a variant of DES, which iterates three times with three separate keys (3 x 56 = 168 bits), effectively doubling the strength of DES.	SHA1 SHA1 (Secure Hash Algorithm) produces a 160-bit digest to authenticate packet data.
	AES Advanced Encryption Standard is a newer method of data encryption that also uses a secret key. This implementation of AES applies a 128-bit key to 128-bit blocks of data. AES is faster than 3DES.	
	Select **NULL** to set up a phase 2 tunnel without encryption.	
AUTHENTICATION	**MD5** (default) MD5 (Message Digest 5) produces a 128-bit digest to authenticate packet data.	**MD5** (default) MD5 (Message Digest 5) produces a 128-bit digest to authenticate packet data.
	SHA1 SHA1 (Secure Hash Algorithm) produces a 160-bit digest to authenticate packet data.	**SHA1** SHA1 (Secure Hash Algorithm) produces a 160-bit digest to authenticate packet data.
	Select **MD5** for minimal security and **SHA1** for maximum security.	

14.3 My IP Address

My IP Address is the WAN IP address of the ZyXEL Device. The ZyXEL Device has to rebuild the VPN tunnel if My IP Address changes after setup.

The following applies if this field is configured as **0.0.0.0**:

- The ZyXEL Device uses the current ZyXEL Device WAN IP address (static or dynamic) to set up the VPN tunnel.
- If the WAN connection goes down, the ZyXEL Device uses the dial backup IP address for the VPN tunnel when using dial backup or the LAN IP address when using traffic redirect. See Chapter 6 on page 83 for details on dial backup and traffic redirect.

14.4 Secure Gateway Address

Secure Gateway Address is the WAN IP address or domain name of the remote IPSec router (secure gateway).

If the remote secure gateway has a static WAN IP address, enter it in the **Secure Gateway Address** field. You may alternatively enter the remote secure gateway's domain name (if it has one) in the **Secure Gateway Address** field.

You can also enter a remote secure gateway's domain name in the **Secure Gateway Address** field if the remote secure gateway has a dynamic WAN IP address and is using DDNS. The ZyXEL Device has to rebuild the VPN tunnel each time the remote secure gateway's WAN IP address changes (there may be a delay until the DDNS servers are updated with the remote gateway's new WAN IP address).

14.4.1 Dynamic Secure Gateway Address

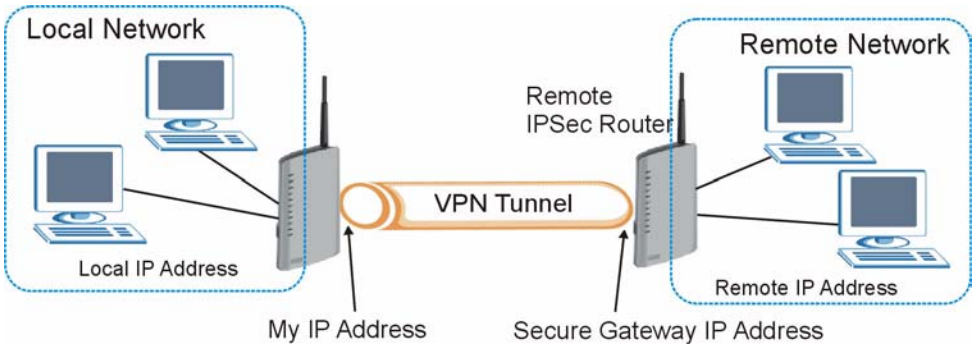
If the remote secure gateway has a dynamic WAN IP address and does not use DDNS, enter 0.0.0.0 as the secure gateway's address. In this case only the remote secure gateway can initiate SAs. This may be useful for telecommuters initiating a VPN tunnel to the company network (seeSection 14.18 on page 207for configuration examples).

The Secure Gateway IP Address may be configured as 0.0.0.0 only when using **IKE** key management and not **Manual** key management.

14.5 VPN Setup Screen

The following figure helps explain the main fields in the web configurator.

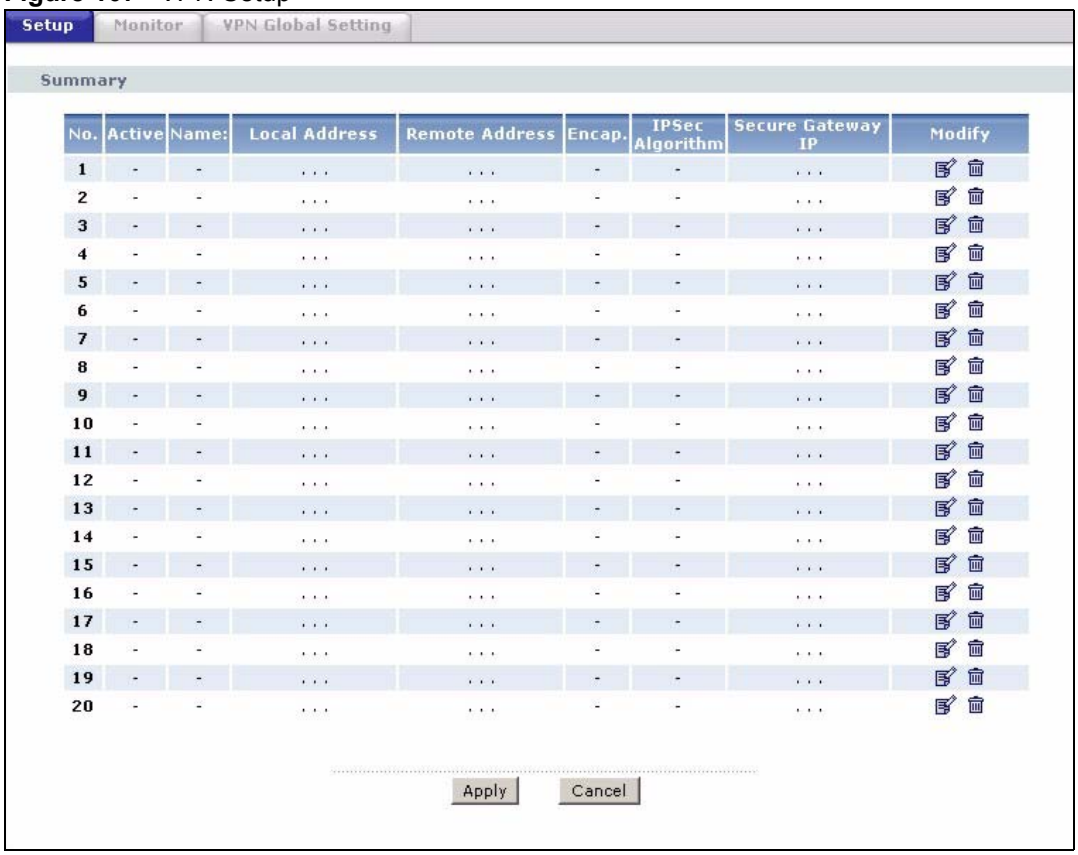
Figure 106 IPSec Summary Fields



Local and remote IP addresses must be static.

Click **Security** > **VPN** to open the **VPN Setup** screen. This is a menu of your IPSec rules (tunnels). The IPSec summary menu is read-only. Edit a VPN by selecting an index number and then configuring its associated submenus.

Figure 107 VPN Setup



The following table describes the fields in this screen.

Table 71 VPN Setup

LABEL	DESCRIPTION
No.	This is the VPN policy index number. Click a number to edit VPN policies.
Active	This field displays whether the VPN policy is active or not. A **Yes** signifies that this VPN policy is active. **No** signifies that this VPN policy is not active.
Name	This field displays the identification name for this VPN policy.
Local Address	This is the IP address(es) of computer(s) on your local network behind your ZyXEL Device. The same (static) IP address is displayed twice when the **Local Address Type** field in the **VPN Setup - Edit** screen is configured to **Single**. The beginning and ending (static) IP addresses, in a range of computers are displayed when the **Local Address Type** field in the **VPN Setup - Edit** screen is configured to **Range**. A (static) IP address and a subnet mask are displayed when the **Local Address Type** field in the **VPN Setup - Edit** screen is configured to **Subnet**.

Table 71 VPN Setup

LABEL	DESCRIPTION
Remote Address	This is the IP address(es) of computer(s) on the remote network behind the remote IPSec router. This field displays **N/A** when the **Secure Gateway Address** field displays **0.0.0.0**. In this case only the remote IPSec router can initiate the VPN. The same (static) IP address is displayed twice when the **Remote Address Type** field in the **VPN Setup - Edit**screen is configured to **Single**. The beginning and ending (static) IP addresses, in a range of computers are displayed when the **Remote Address Type** field in the **VPN Setup - Edit** screen is configured to **Range**. A (static) IP address and a subnet mask are displayed when the **Remote Address Type** field in the **VPN Setup - Edit** screen is configured to **Subnet**.
Encap.	This field displays **Tunnel** or **Transport** mode (**Tunnel** is the default selection).
IPSec Algorithm	This field displays the security protocols used for an SA. Both **AH** and **ESP** increase ZyXEL Device processing requirements and communications latency (delay).
Secure Gateway IP	This is the static WAN IP address or URL of the remote IPSec router. This field displays **0.0.0.0** when you configure the **Secure Gateway Address** field in the **VPN-IKE** screen to **0.0.0.0.**
Modify	Click the **Edit** icon to go to the screen where you can edit the VPN configuration. Click the **Remove** icon to remove an existing VPN configuration.
Apply	Click this to save your changes and apply them to the ZyXEL Device.
Cancel	Click this return your settings to their last saved values.

14.6 Keep Alive

When you initiate an IPSec tunnel with keep alive enabled, the ZyXEL Device automatically renegotiates the tunnel when the IPSec SA lifetime period expires (see Section 14.12 on page 198 for more on the IPSec SA lifetime). In effect, the IPSec tunnel becomes an “always on” connection after you initiate it. Both IPSec routers must have a ZyXEL Device-compatible keep alive feature enabled in order for this feature to work.

If the ZyXEL Device has its maximum number of simultaneous IPSec tunnels connected to it and they all have keep alive enabled, then no other tunnels can take a turn connecting to the ZyXEL Device because the ZyXEL Device never drops the tunnels that are already connected.

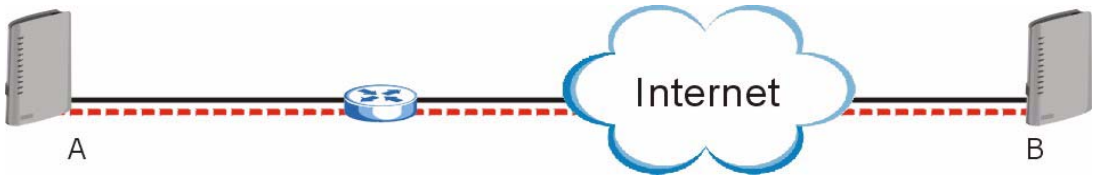
When there is outbound traffic with no inbound traffic, the ZyXEL Device automatically drops the tunnel after two minutes.

14.7 VPN, NAT, and NAT Traversal

NAT is incompatible with the AH protocol in both transport and tunnel mode. An IPSec VPN using the AH protocol digitally signs the outbound packet, both data payload and headers, with a hash value appended to the packet, but a NAT device between the IPSec endpoints rewrites the source or destination address. As a result, the VPN device at the receiving end finds a mismatch between the hash value and the data and assumes that the data has been maliciously altered.

NAT is not normally compatible with ESP in transport mode either, but the ZyXEL Device's **NAT Traversal** feature provides a way to handle this. NAT traversal allows you to set up an IKE SA when there are NAT routers between the two IPSec routers.

Figure 108 NAT Router Between IPSec Routers



Normally you cannot set up an IKE SA with a NAT router between the two IPSec routers because the NAT router changes the header of the IPSec packet. NAT traversal solves the problem by adding a UDP port 500 header to the IPSec packet. The NAT router forwards the IPSec packet with the UDP port 500 header unchanged. In Figure 108 on page 190, when IPSec router A tries to establish an IKE SA, IPSec router B checks the UDP port 500 header, and IPSec routers A and B build the IKE SA.

For NAT traversal to work, you must:

- Use ESP security protocol (in either transport or tunnel mode).
- Use IKE keying mode.
- Enable NAT traversal on both IPSec endpoints.
- Set the NAT router to forward UDP port 500 to IPSec router A.

Finally, NAT is compatible with ESP in tunnel mode because integrity checks are performed over the combination of the "original header plus original payload," which is unchanged by a NAT device. The compatibility of AH and ESP with NAT in tunnel and transport modes is summarized in the following table.

Table 72 VPN and NAT

SECURITY PROTOCOL	MODE	NAT
AH	Transport	N
AH	Tunnel	N
ESP	Transport	Y*
ESP	Tunnel	Y

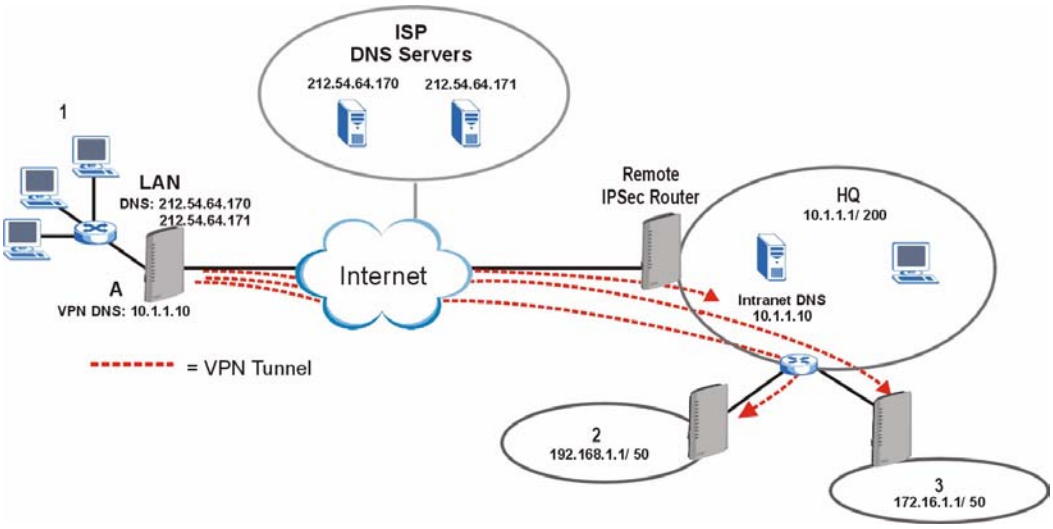
Y* - This is supported in the ZyXEL Device if you enable NAT traversal.

14.8 Remote DNS Server

In cases where you want to use domain names to access Intranet servers on a remote network that has a DNS server, you must identify that DNS server. You cannot use DNS servers on the LAN or from the ISP since these DNS servers cannot resolve domain names to private IP addresses on the remote network

The following figure depicts an example where three VPN tunnels are created from ZyXEL Device A; one to branch office 2, one to branch office 3 and another to headquarters. In order to access computers that use private domain names on the headquarters (HQ) network, the ZyXEL Device at branch office 1 uses the Intranet DNS server in headquarters. The DNS server feature for VPN does not work with Windows 2000 or Windows XP.

Figure 109 VPN Host using Intranet DNS Server Example



If you do not specify an Intranet DNS server on the remote network, then the VPN host must use IP addresses to access the computers on the remote network.

14.9 ID Type and Content

With aggressive negotiation mode (seeSection 14.12.1 on page 199), the ZyXEL Device identifies incoming SAs by ID type and content since this identifying information is not encrypted. This enables the ZyXEL Device to distinguish between multiple rules for SAs that connect from remote IPSec routers that have dynamic WAN IP addresses. Telecommuters can use separate passwords to simultaneously connect to the ZyXEL Device from IPSec routers with dynamic IP addresses (seeSection 14.18 on page 207 for a telecommuter configuration example).

Regardless of the ID type and content configuration, the ZyXEL Device does not allow you to save multiple active rules with overlapping local and remote IP addresses.

With main mode (seeSection 14.12.1 on page 199), the ID type and content are encrypted to provide identity protection. In this case the ZyXEL Device can only distinguish between up to 12 different incoming SAs that connect from remote IPSec routers that have dynamic WAN IP addresses. The ZyXEL Device can distinguish up to 12 incoming SAs because you can select between three encryption algorithms (DES, 3DES and AES), two authentication algorithms (MD5 and SHA1) and two key groups (DH1 and DH2) when you configure a VPN rule (seeSection 14.13 on page 200). The ID type and content act as an extra level of identification for incoming SAs.

The type of ID can be a domain name, an IP address or an e-mail address. The content is the IP address, domain name, or e-mail address.

Table 73 Local ID Type and Content Fields

LOCAL ID TYPE=	CONTENT=
IP	Type the IP address of your computer or leave the field blank to have the ZyXEL Device automatically use its own IP address.
DNS	Type a domain name (up to 31 characters) by which to identify this ZyXEL Device.
E-mail	Type an e-mail address (up to 31 characters) by which to identify this ZyXEL Device.
	The domain name or e-mail address that you use in the **Content** field is used for identification purposes only and does not need to be a real domain name or e-mail address.

Table 74 Peer ID Type and Content Fields

PEER ID TYPE=	CONTENT=
IP	Type the IP address of the computer with which you will make the VPN connection or leave the field blank to have the ZyXEL Device automatically use the address in the **Secure Gateway Address** field.
DNS	Type a domain name (up to 31 characters) by which to identify the remote IPSec router.
E-mail	Type an e-mail address (up to 31 characters) by which to identify the remote IPSec router.
	The domain name or e-mail address that you use in the **Content** field is used for identification purposes only and does not need to be a real domain name or e-mail address. The domain name also does not have to match the remote router's IP address or what you configure in the **Secure Gateway Address** field below.

14.9.1 ID Type and Content Examples

Two IPSec routers must have matching ID type and content configuration in order to set up a VPN tunnel.

The two ZyXEL Devices in this example can complete negotiation and establish a VPN tunnel.

Table 75 Matching ID Type and Content Configuration Example

ZYXEL DEVICE A	ZYXEL DEVICE B
Local ID type: E-mail	Local ID type: IP
Local ID content: tom@yourcompany.com	Local ID content: 1.1.1.2
Peer ID type: IP	Peer ID type: E-mail
Peer ID content: 1.1.1.2	Peer ID content: tom@yourcompany.com

The two ZyXEL Devices in this example cannot complete their negotiation because ZyXEL Device B's **Local ID type** is **IP**, but ZyXEL Device A's **Peer ID type** is set to **E-mail**. An "ID mismatched" message displays in the IPSEC LOG.

Table 76 Mismatching ID Type and Content Configuration Example

ZYXEL DEVICE A	ZYXEL DEVICE B
Local ID type: IP	Local ID type: IP
Local ID content: 1.1.1.10	Local ID content: 1.1.1.10
Peer ID type: E-mail	Peer ID type: IP
Peer ID content: aa@yahoo.com	Peer ID content: N/A

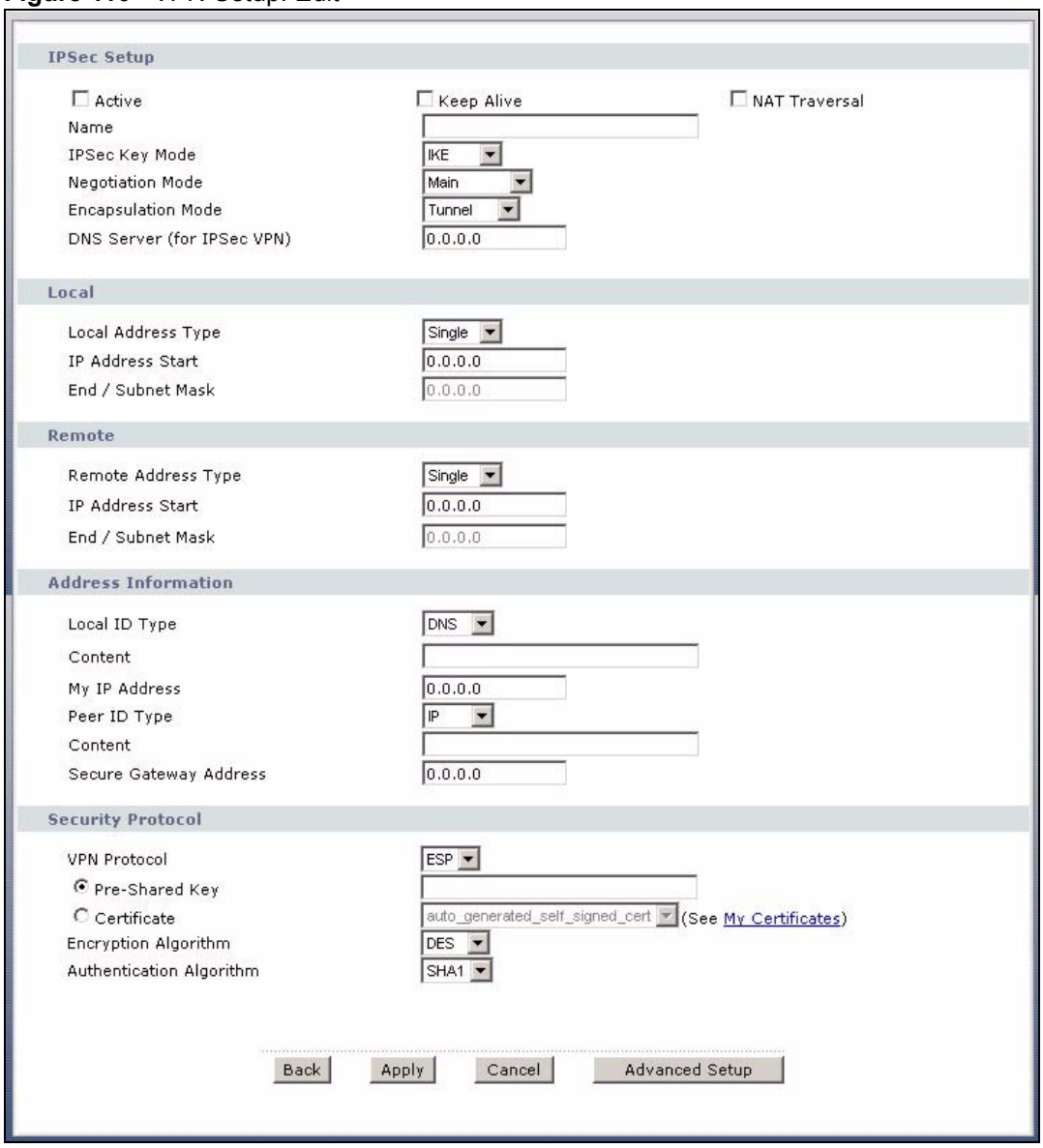
14.10 Pre-Shared Key

A pre-shared key identifies a communicating party during a phase 1 IKE negotiation (seeSection 14.12 on page 198for more on IKE phases). It is called "pre-shared" because you have to share it with another party before you can communicate with them over a secure connection.

14.11 Editing VPN Policies

Click an **Edit** icon in the **VPN Setup** screen to edit VPN policies.

Figure 110 VPN Setup: Edit



The following table describes the fields in this screen.

Table 77 VPN Setup; Edit

LABEL	DESCRIPTION
IPSec Setup	
Active	Select this check box to activate this VPN policy. This option determines whether a VPN rule is applied before a packet leaves the firewall.
Keep Alive	Select either **Yes** or **No** from the drop-down list box. Select **Yes** to have the ZyXEL Device automatically reinitiate the SA after the SA lifetime times out, even if there is no traffic. The remote IPSec router must also have keep alive enabled in order for this feature to work.

Table 77 VPN Setup; Edit

LABEL	DESCRIPTION
NAT Traversal	This function is available if the **VPN protocol** is **ESP**. Select this check box if you want to set up a VPN tunnel when there are NAT routers between the ZyXEL Device and remote IPSec router. The remote IPSec router must also enable NAT traversal, and the NAT routers have to forward UDP port 500 packets to the remote IPSec router behind the NAT router.
Name	Type up to 32 characters to identify this VPN policy. You may use any character, including spaces, but the ZyXEL Device drops trailing spaces.
IPSec Key Mode	Select **IKE** or **Manual** from the drop-down list box. **IKE** provides more protection so it is generally recommended. **Manual** is a useful option for troubleshooting if you have problems using **IKE** key management.
Negotiation Mode	Select **Main** or **Aggressive** from the drop-down list box. Multiple SAs connecting through a secure gateway must have the same negotiation mode.
Encapsulation Mode	Select **Tunnel** mode or **Transport** mode from the drop-down list box.
DNS Server (for IPSec VPN)	If there is a private DNS server that services the VPN, type its IP address here. The ZyXEL Device assigns this additional DNS server to the ZyXEL Device's DHCP clients that have IP addresses in this IPSec rule's range of local addresses. A DNS server allows clients on the VPN to find other computers and servers on the VPN by their (private) domain names.
Local	Specify the IP addresses of the devices behind the ZyXEL Device that can use the VPN tunnel. The local IP addresses must correspond to the remote IPSec router's configured remote IP addresses. Two active SAs cannot have the local and remote IP address(es) both the same. Two active SAs can have the same local or remote IP address, but not both. You can configure multiple SAs between the same local and remote IP addresses, as long as only one is active at any time.
Local Address Type	Use the drop-down menu to choose **Single**, **Range**, or **Subnet**. Select **Single** for a single IP address. Select **Range** for a specific range of IP addresses. Select **Subnet** to specify IP addresses on a network by their subnet mask.
IP Address Start	When the **Local Address Type** field is configured to **Single**, enter a (static) IP address on the LAN behind your ZyXEL Device. When the **Local Address Type** field is configured to **Range**, enter the beginning (static) IP address, in a range of computers on your LAN behind your ZyXEL Device. When the **Local Address Type** field is configured to **Subnet**, this is a (static) IP address on the LAN behind your ZyXEL Device.
End / Subnet Mask	When the **Local Address Type** field is configured to **Single**, this field is N/A. When the **Local Address Type** field is configured to **Range**, enter the end (static) IP address, in a range of computers on the LAN behind your ZyXEL Device. When the **Local Address Type** field is configured to **Subnet**, this is a subnet mask on the LAN behind your ZyXEL Device.
Remote	Specify the IP addresses of the devices behind the remote IPSec router that can use the VPN tunnel. The remote IP addresses must correspond to the remote IPSec router's configured local IP addresses. Two active SAs cannot have the local and remote IP address(es) both the same. Two active SAs can have the same local or remote IP address, but not both. You can configure multiple SAs between the same local and remote IP addresses, as long as only one is active at any time.
Remote Address Type	Use the drop-down menu to choose **Single**, **Range**, or **Subnet**. Select **Single** with a single IP address. Select **Range** for a specific range of IP addresses. Select **Subnet** to specify IP addresses on a network by their subnet mask.

Table 77 VPN Setup; Edit

LABEL	DESCRIPTION
IP Address Start	When the **Remote Address Type** field is configured to **Single**, enter a (static) IP address on the network behind the remote IPSec router. When the **Remote Address Type** field is configured to **Range**, enter the beginning (static) IP address, in a range of computers on the network behind the remote IPSec router. When the **Remote Address Type** field is configured to **Subnet**, enter a (static) IP address on the network behind the remote IPSec router.
End / Subnet Mask	When the **Remote Address Type** field is configured to **Single**, this field is N/A. When the **Remote Address Type** field is configured to **Range**, enter the end (static) IP address, in a range of computers on the network behind the remote IPSec router. When the **Remote Address Type** field is configured to **Subnet**, enter a subnet mask on the network behind the remote IPSec router.
Address Information	
Local ID Type	Select **IP** to identify this ZyXEL Device by its IP address. Select **DNS** to identify this ZyXEL Device by a domain name. Select **E-mail** to identify this ZyXEL Device by an e-mail address.
Content	When you select **IP** in the **Local ID Type** field, type the IP address of your computer in the local **Content** field. The ZyXEL Device automatically uses the IP address in the **My IP Address** field (refer to the **My IP Address** field description) if you configure the local **Content** field to **0.0.0.0** or leave it blank. It is recommended that you type an IP address other than **0.0.0.0** in the local **Content** field or use the **DNS** or **E-mail** ID type in the following situations. When there is a NAT router between the two IPSec routers. When you want the remote IPSec router to be able to distinguish between VPN connection requests that come in from IPSec routers with dynamic WAN IP addresses. When you select **DNS** or **E-mail** in the **Local ID Type** field, type a domain name or e-mail address by which to identify this ZyXEL Device in the local **Content** field. Use up to 31 ASCII characters including spaces, although trailing spaces are truncated. The domain name or e-mail address is for identification purposes only and can be any string.
My IP Address	Enter the WAN IP address of your ZyXEL Device. The VPN tunnel has to be rebuilt if this IP address changes. The following applies if this field is configured as **0.0.0.0**: The ZyXEL Device uses the current ZyXEL Device WAN IP address (static or dynamic) to set up the VPN tunnel. If the WAN connection goes down, the ZyXEL Device uses the dial backup IP address for the VPN tunnel when using dial backup or the LAN IP address when using traffic redirect. See Chapter 6 on page 83 for details on dial backup and traffic redirect.
Peer ID Type	Select **IP** to identify the remote IPSec router by its IP address. Select **DNS** to identify the remote IPSec router by a domain name. Select **E-mail** to identify the remote IPSec router by an e-mail address.

Table 77 VPN Setup; Edit

LABEL	DESCRIPTION
Content	The configuration of the peer content depends on the peer ID type. For **IP**, type the IP address of the computer with which you will make the VPN connection. If you configure this field to **0.0.0.0** or leave it blank, the ZyXEL Device will use the address in the **Secure Gateway Address** field (refer to the **Secure Gateway Address** field description). For **DNS** or **E-mail**, type a domain name or e-mail address by which to identify the remote IPSec router. Use up to 31 ASCII characters including spaces, although trailing spaces are truncated. The domain name or e-mail address is for identification purposes only and can be any string. It is recommended that you type an IP address other than **0.0.0.0** or use the **DNS** or **E-mail** ID type in the following situations: When there is a NAT router between the two IPSec routers. When you want the ZyXEL Device to distinguish between VPN connection requests that come in from remote IPSec routers with dynamic WAN IP addresses.
Secure Gateway Address	Type the WAN IP address or the URL (up to 31 characters) of the IPSec router with which you're making the VPN connection. Set this field to **0.0.0.0** if the remote IPSec router has a dynamic WAN IP address (the **Key Management** field must be set to **IKE**). In order to have more than one active rule with the **Secure Gateway Address** field set to **0.0.0.0**, the ranges of the local IP addresses cannot overlap between rules. If you configure an active rule with **0.0.0.0** in the **Secure Gateway Address** field and the LAN's full IP address range as the local IP address, then you cannot configure any other active rules with the **Secure Gateway Address** field set to **0.0.0.0**.
Security Protocol	
VPN Protocol	Select **ESP** if you want to use ESP (Encapsulation Security Payload). The ESP protocol (RFC 2406) provides encryption as well as some of the services offered by **AH**. If you select **ESP** here, you must select options from the **Encryption Algorithm** and **Authentication Algorithm** fields (described below).
Pre-Shared Key	Click the button to use a pre-shared key for authentication, and type in your pre-shared key. A pre-shared key identifies a communicating party during a phase 1 IKE negotiation. It is called "pre-shared" because you have to share it with another party before you can communicate with them over a secure connection. Type from 8 to 31 case-sensitive ASCII characters or from 16 to 62 hexadecimal ("0-9", "A-F") characters. You must precede a hexadecimal key with a "0x" (zero x), which is not counted as part of the 16 to 62 character range for the key. For example, in "0x0123456789ABCDEF", "0x" denotes that the key is hexadecimal and "0123456789ABCDEF" is the key itself. Both ends of the VPN tunnel must use the same pre-shared key. You will receive a "PYLD_MALFORMED" (payload malformed) packet if the same pre-shared key is not used on both ends.
Certificate	Click the button to use a certificate for authentication. Select the certificate you want to use from the list. You can create, import and configure certificates in the **Security > Certificates** screens, or click the **My Certificates** link.
My Certificates	Click this to go to the **Security > Certificates > My Certificates** screen. If you do not click **Apply** first, your VPN settings will not be saved.

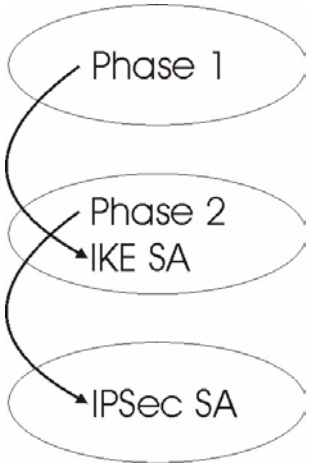
Table 77 VPN Setup; Edit

LABEL	DESCRIPTION
Encryption Algorithm	Select **DES**, **3DES**, **AES** or **NULL** from the drop-down list box. When you use one of these encryption algorithms for data communications, both the sending device and the receiving device must use the same secret key, which can be used to encrypt and decrypt the message or to generate and verify a message authentication code. The DES encryption algorithm uses a 56-bit key. Triple DES (**3DES**) is a variation on **DES** that uses a 168-bit key. As a result, **3DES** is more secure than **DES**. It also requires more processing power, resulting in increased latency and decreased throughput. This implementation of **AES** uses a 128-bit key. **AES** is faster than **3DES**. Select **NULL** to set up a tunnel without encryption. When you select **NULL**, you do not enter an encryption key.
Authentication Algorithm	Select **SHA1** or **MD5** from the drop-down list box. **MD5** (Message Digest 5) and **SHA1** (Secure Hash Algorithm) are hash algorithms used to authenticate packet data. The **SHA1** algorithm is generally considered stronger than **MD5**, but is slower. Select **MD5** for minimal security and **SHA-1** for maximum security.
Advanced Setup	Click **Advanced** to configure more detailed settings of your IKE key management.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.
Advanced Setup	Click **Advanced Setup** to configure more detailed settings of your IKE key management.

14.12 IKE Phases

There are two phases to every IKE (Internet Key Exchange) negotiation – phase 1 (Authentication) and phase 2 (Key Exchange). A phase 1 exchange establishes an IKE SA and the second one uses that SA to negotiate SAs for IPSec.

Figure 111 Two Phases to Set Up the IPSec SA



In phase 1 you must:

- Choose a negotiation mode.
- Authenticate the connection by entering a pre-shared key.

- Choose an encryption algorithm.
- Choose an authentication algorithm.
- Choose a Diffie-Hellman public-key cryptography key group (**DH1** or **DH2**).
- Set the IKE SA lifetime. This field allows you to determine how long an IKE SA should stay up before it times out. An IKE SA times out when the IKE SA lifetime period expires. If an IKE SA times out when an IPSec SA is already established, the IPSec SA stays connected.

In phase 2 you must:

- Choose which protocol to use (**ESP** or **AH**) for the IKE key exchange.
- Choose an encryption algorithm.
- Choose an authentication algorithm
- Choose whether to enable Perfect Forward Secrecy (PFS) using Diffie-Hellman public-key cryptography – see Section 14.12.3 on page 200. Select **None** (the default) to disable PFS.
- Choose **Tunnel** mode or **Transport** mode.
- Set the IPSec SA lifetime. This field allows you to determine how long the IPSec SA should stay up before it times out. The ZyXEL Device automatically renegotiates the IPSec SA if there is traffic when the IPSec SA lifetime period expires. The ZyXEL Device also automatically renegotiates the IPSec SA if both IPSec routers have keep alive enabled, even if there is no traffic. If an IPSec SA times out, then the IPSec router must renegotiate the SA the next time someone attempts to send traffic.

14.12.1 Negotiation Mode

The phase 1 **Negotiation Mode** you select determines how the Security Association (SA) will be established for each connection through IKE negotiations.

- **Main Mode** ensures the highest level of security when the communicating parties are negotiating authentication (phase 1). It uses 6 messages in three round trips: SA negotiation, Diffie-Hellman exchange and an exchange of nonces (a nonce is a random number). This mode features identity protection (your identity is not revealed in the negotiation).
- **Aggressive Mode** is quicker than **Main Mode** because it eliminates several steps when the communicating parties are negotiating authentication (phase 1). However the trade-off is that faster speed limits its negotiating power and it also does not provide identity protection. It is useful in remote access situations where the address of the initiator is not know by the responder and both parties want to use pre-shared key authentication.

14.12.2 Diffie-Hellman (DH) Key Groups

Diffie-Hellman (DH) is a public-key cryptography protocol that allows two parties to establish a shared secret over an unsecured communications channel. Diffie-Hellman is used within IKE SA setup to establish session keys. 768-bit (Group 1 - **DH1**) and 1024-bit (Group 2 – **DH2**) Diffie-Hellman groups are supported. Upon completion of the Diffie-Hellman exchange, the two peers have a shared secret, but the IKE SA is not authenticated. For authentication, use pre-shared keys.

14.12.3 Perfect Forward Secrecy (PFS)

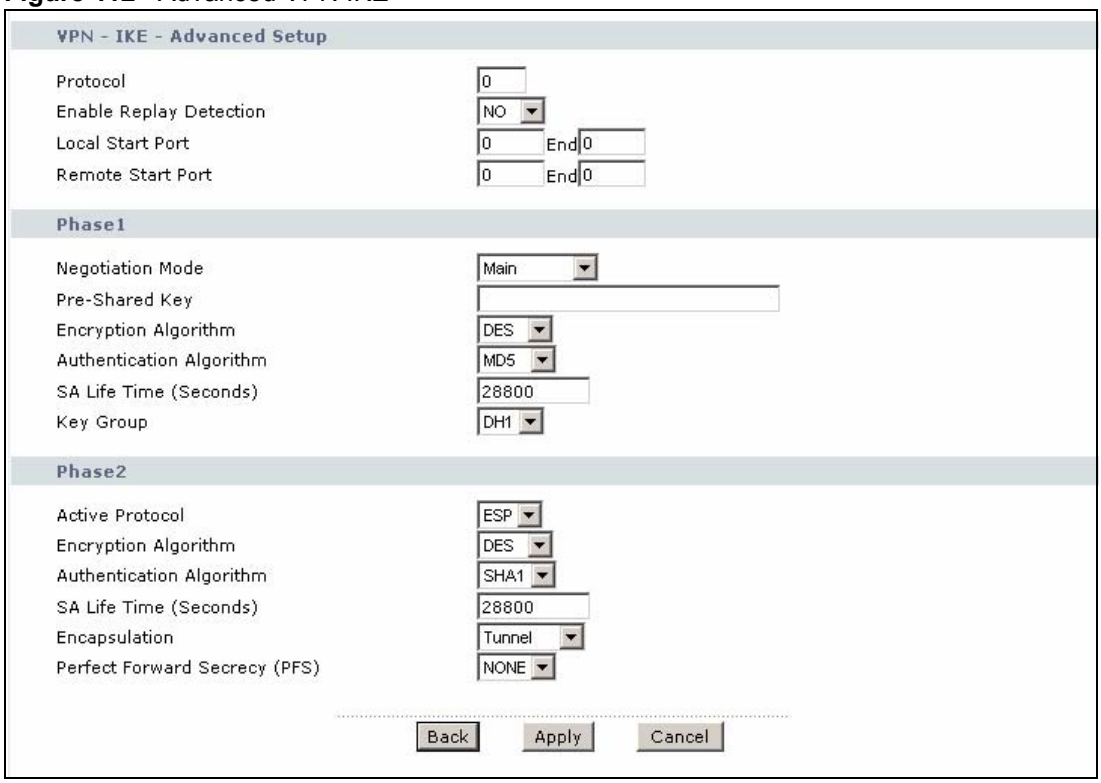
Enabling PFS means that the key is transient. The key is thrown away and replaced by a brand new key using a new Diffie-Hellman exchange for each new IPSec SA setup. With PFS enabled, if one key is compromised, previous and subsequent keys are not compromised, because subsequent keys are not derived from previous keys. The (time-consuming) Diffie-Hellman exchange is the trade-off for this extra security.

This may be unnecessary for data that does not require such security, so PFS is disabled (**None**) by default in the ZyXEL Device. Disabling PFS means new authentication and encryption keys are derived from the same root secret (which may have security implications in the long run) but allows faster SA setup (by bypassing the Diffie-Hellman key exchange).

14.13 Configuring Advanced IKE Settings

Click **Advanced Setup** in the **VPN Setup-Edit** screen to open this screen.

Figure 112 Advanced VPN IKE



The following table describes the fields in this screen.

Table 78 Advanced VPN IKE

LABEL	DESCRIPTION
VPN - IKE	
Protocol	Enter 1 for ICMP, 6 for TCP, 17 for UDP, etc. 0 is the default and signifies any protocol.

Table 78 Advanced VPN IKE

LABEL	DESCRIPTION
Enable Replay Detection	As a VPN setup is processing intensive, the system is vulnerable to Denial of Service (DoS) attacks The IPSec receiver can detect and reject old or duplicate packets to protect against replay attacks. Select **YES** from the drop-down menu to enable replay detection, or select **NO** to disable it.
Local Start Port	0 is the default and signifies any port. Type a port number from 0 to 65535. Some of the most common IP ports are: 21, FTP; 53, DNS; 23, Telnet; 80, HTTP; 25, SMTP; 110, POP3.
End	Enter a port number in this field to define a port range. This port number must be greater than that specified in the previous field. If **Local Start Port** is left at 0, **End** will also remain at 0.
Remote Start Port	0 is the default and signifies any port. Type a port number from 0 to 65535. Some of the most common IP ports are: 21, FTP; 53, DNS; 23, Telnet; 80, HTTP; 25, SMTP; 110, POP3.
End	Enter a port number in this field to define a port range. This port number must be greater than that specified in the previous field. If **Remote Start Port** is left at 0, **End** will also remain at 0.
Phase 1	
Negotiation Mode	Select **Main** or **Aggressive** from the drop-down list box. Multiple SAs connecting through a secure gateway must have the same negotiation mode.
Pre-Shared Key	Type your pre-shared key in this field. A pre-shared key identifies a communicating party during a phase 1 IKE negotiation. It is called "pre-shared" because you have to share it with another party before you can communicate with them over a secure connection. Type from 8 to 31 case-sensitive ASCII characters or from 16 to 62 hexadecimal ("0-9", "A-F") characters. You must precede a hexadecimal key with a "0x" (zero x), which is not counted as part of the 16 to 62-character range for the key. For example, in "0x0123456789ABCDEF", “0x” denotes that the key is hexadecimal and “0123456789ABCDEF” is the key itself. Both ends of the VPN tunnel must use the same pre-shared key. You will receive a “PYLD_MALFORMED” (payload malformed) packet if the same pre-shared key is not used on both ends.
Encryption Algorithm	Select **DES**, **3DES** or **AES** from the drop-down list box. When you use one of these encryption algorithms for data communications, both the sending device and the receiving device must use the same secret key, which can be used to encrypt and decrypt the message or to generate and verify a message authentication code. The DES encryption algorithm uses a 56-bit key. Triple DES (**3DES**) is a variation on **DES** that uses a 168-bit key. As a result, **3DES** is more secure than **DES**. It also requires more processing power, resulting in increased latency and decreased throughput. This implementation of AES uses a 128-bit key. **AES** is faster than **3DES**.
Authentication Algorithm	Select **SHA1** or **MD5** from the drop-down list box. **MD5** (Message Digest 5) and **SHA1** (Secure Hash Algorithm) are hash algorithms used to authenticate packet data. The **SHA1** algorithm is generally considered stronger than **MD5**, but is slower. Select **MD5** for minimal security and **SHA-1** for maximum security.
SA Life Time (Seconds)	Define the length of time before an IPSec SA automatically renegotiates in this field. It may range from 60 to 3,000,000 seconds (almost 35 days). A short SA Life Time increases security by forcing the two VPN gateways to update the encryption and authentication keys. However, every time the VPN tunnel renegotiates, all users accessing remote resources are temporarily disconnected.
Key Group	You must choose a key group for phase 1 IKE setup. **DH1** (default) refers to Diffie-Hellman Group 1 a 768 bit random number. **DH2** refers to Diffie-Hellman Group 2 a 1024 bit (1Kb) random number.

Table 78 Advanced VPN IKE

LABEL	DESCRIPTION
Phase 2	
Active Protocol	Use the drop-down list box to choose from **ESP** or **AH**.
Encryption Algorithm	This field is available when you select **ESP** in the **Active Protocol** field. Select **DES**, **3DES**, **AES** or **NULL** from the drop-down list box. When you use one of these encryption algorithms for data communications, both the sending device and the receiving device must use the same secret key, which can be used to encrypt and decrypt the message or to generate and verify a message authentication code. The DES encryption algorithm uses a 56-bit key. Triple DES (**3DES**) is a variation on DES that uses a 168-bit key. As a result, **3DES** is more secure than **DES**. It also requires more processing power, resulting in increased latency and decreased throughput. This implementation of AES uses a 128-bit key. **AES** is faster than **3DES**. Select **NULL** to set up a tunnel without encryption. When you select **NULL**, you do not enter an encryption key.
Authentication Algorithm	Select **SHA1** or **MD5** from the drop-down list box. MD5 (Message Digest 5) and SHA1 (Secure Hash Algorithm) are hash algorithms used to authenticate packet data. The SHA1 algorithm is generally considered stronger than MD5, but is slower. Select **MD5** for minimal security and **SHA-1** for maximum security.
SA Life Time (Seconds)	Define the length of time before an IKE SA automatically renegotiates in this field. It may range from 60 to 3,000,000 seconds (almost 35 days). A short SA Life Time increases security by forcing the two VPN gateways to update the encryption and authentication keys. However, every time the VPN tunnel renegotiates, all users accessing remote resources are temporarily disconnected.
Encapsulation	Select **Tunnel** mode or **Transport** mode from the drop-down list box.
Perfect Forward Secrecy (PFS)	Perfect Forward Secrecy (PFS) is disabled (**NONE**) by default in phase 2 IPSec SA setup. This allows faster IPSec setup, but is not so secure. Choose **DH1** or **DH2** from the drop-down list box to enable PFS. **DH1** refers to Diffie-Hellman Group 1 a 768 bit random number. **DH2** refers to Diffie-Hellman Group 2 a 1024 bit (1Kb) random number (more secure, yet slower).
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save your changes back to the ZyXEL Device and return to the **VPN-IKE** screen.
Cancel	Click **Cancel** to return to the **VPN-IKE** screen without saving your changes.

14.14 Manual Key Setup

Manual key management is useful if you have problems with **IKE** key management.

14.14.1 Security Parameter Index (SPI)

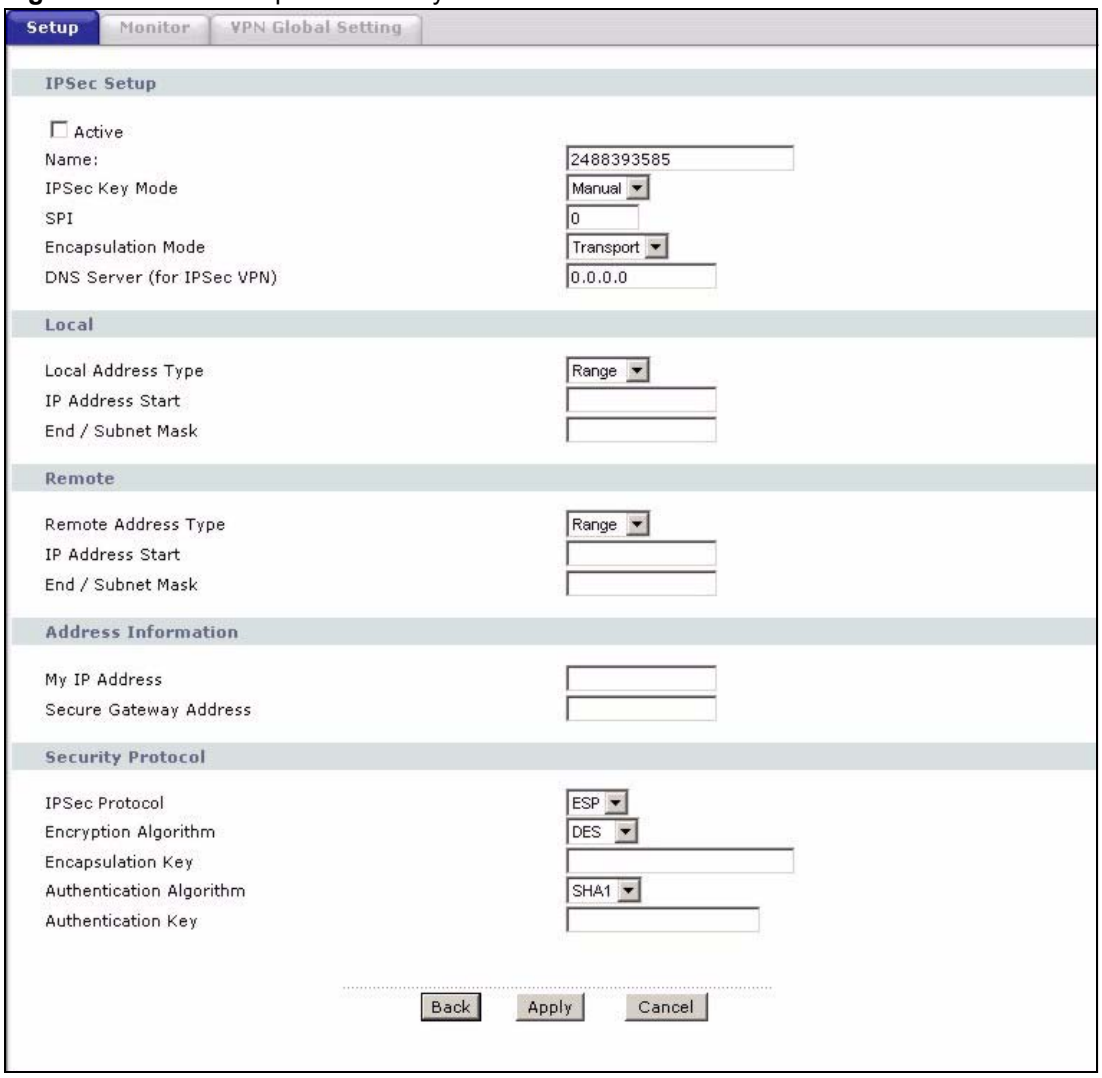
An SPI is used to distinguish different SAs terminating at the same destination and using the same IPSec protocol. This data allows for the multiplexing of SAs to a single gateway. The **SPI** (Security Parameter Index) along with a destination IP address uniquely identify a particular Security Association (SA). The **SPI** is transmitted from the remote VPN gateway to the local VPN gateway. The local VPN gateway then uses the network, encryption and key values that the administrator associated with the SPI to establish the tunnel.

Current ZyXEL implementation assumes identical outgoing and incoming SPIs.

14.15 Configuring Manual Key

You only configure VPN manual key when you select **Manual** in the **IPSec Key Mode** field on the **VPN Setup-Edit** screen. This is the **VPN Setup - Manual Key** screen as shown next.

Figure 113 VPN Setup: Manual Key



The following table describes the fields in this screen.

Table 79 VPN Setup: Manual Key

LABEL	DESCRIPTION
IPSec Setup	
Active	Select this check box to activate this VPN policy.
Name	Type up to 32 characters to identify this VPN policy. You may use any character, including spaces, but the ZyXEL Device drops trailing spaces.
IPSec Key Mode	Select **IKE** or **Manual** from the drop-down list box. **Manual** is a useful option for troubleshooting if you have problems using **IKE** key management.
SPI	Type a number (base 10) from 1 to 999999 for the Security Parameter Index.

Table 79 VPN Setup: Manual Key (continued)

LABEL	DESCRIPTION
Encapsulation Mode	Select **Tunnel** mode or **Transport** mode from the drop-down list box.
DNS Server (for IPSec VPN)	If there is a private DNS server that services the VPN, type its IP address here. The ZyXEL Device assigns this additional DNS server to the ZyXEL Device 's DHCP clients that have IP addresses in this IPSec rule's range of local addresses. A DNS server allows clients on the VPN to find other computers and servers on the VPN by their (private) domain names.
Local	Local IP addresses must be static and correspond to the remote IPSec router's configured remote IP addresses. Two active SAs cannot have the local and remote IP address(es) both the same. Two active SAs can have the same local or remote IP address, but not both. You can configure multiple SAs between the same local and remote IP addresses, as long as only one is active at any time.
Local Address Type	Use the drop-down menu to choose **Single**, **Range**, or **Subnet**. Select **Single** for a single IP address. Select **Range** for a specific range of IP addresses. Select **Subnet** to specify IP addresses on a network by their subnet mask.
IP Address Start	When the **Local Address Type** field is configured to **Single**, enter a (static) IP address on the LAN behind your ZyXEL Device. When the **Local Address Type** field is configured to **Range**, enter the beginning (static) IP address, in a range of computers on your LAN behind your ZyXEL Device. When the **Local Address Type** field is configured to **Subnet**, this is a (static) IP address on the LAN behind your ZyXEL Device.
End / Subnet Mask	When the **Local Address Type** field is configured to **Single**, this field is N/A. When the **Local Address Type** field is configured to **Range**, enter the end (static) IP address, in a range of computers on the LAN behind your ZyXEL Device. When the **Local Address Type** field is configured to **Subnet**, this is a subnet mask on the LAN behind your ZyXEL Device.
Remote	Remote IP addresses must be static and correspond to the remote IPSec router's configured local IP addresses. Two active SAs cannot have the local and remote IP address(es) both the same. Two active SAs can have the same local or remote IP address, but not both. You can configure multiple SAs between the same local and remote IP addresses, as long as only one is active at any time.
Remote Address Type	Use the drop-down menu to choose **Single**, **Range**, or **Subnet**. Select **Single** with a single IP address. Select **Range** for a specific range of IP addresses. Select **Subnet** to specify IP addresses on a network by their subnet mask.
IP Address Start	When the **Remote Address Type** field is configured to Single, enter a (static) IP address on the network behind the remote IPSec router. When the **Remote Address Type** field is configured to **Range**, enter the beginning (static) IP address, in a range of computers on the network behind the remote IPSec router. When the **Remote Address Type** field is configured to **Subnet**, enter a (static) IP address on the network behind the remote IPSec router.
End / Subnet Mask	When the **Remote Address Type** field is configured to **Single**, this field is N/A. When the **Remote Address Type** field is configured to **Range**, enter the end (static) IP address, in a range of computers on the network behind the remote IPSec router. When the **Remote Address Type** field is configured to **Subnet**, enter a subnet mask on the network behind the remote IPSec router.
Address Information	

Table 79 VPN Setup: Manual Key (continued)

LABEL	DESCRIPTION
My IP Address	Enter the WAN IP address of your ZyXEL Device. The VPN tunnel has to be rebuilt if this IP address changes. The following applies if this field is configured as **0.0.0.0**: The ZyXEL Device uses the current ZyXEL Device WAN IP address (static or dynamic) to set up the VPN tunnel. If the WAN connection goes down, the ZyXEL Device uses the dial backup IP address for the VPN tunnel when using dial backup or the LAN IP address when using traffic redirect. See Chapter 6 on page 83 for details on dial backup and traffic redirect.
Secure Gateway Address	Type the WAN IP address or the URL (up to 31 characters) of the IPSec router with which you're making the VPN connection.
Security Protocol	
IPSec Protocol	Select **ESP** if you want to use ESP (Encapsulation Security Payload). The ESP protocol (RFC 2406) provides encryption as well as some of the services offered by **AH**. If you select ESP here, you must select options from the **Encryption Algorithm** and **Authentication Algorithm** fields (described next).
Encryption Algorithm	Select **DES**, **3DES** or **NULL** from the drop-down list box. When **DES** is used for data communications, both sender and receiver must know the same secret key, which can be used to encrypt and decrypt the message or to generate and verify a message authentication code. The **DES** encryption algorithm uses a 56-bit key. Triple DES (**3DES**) is a variation on **DES** that uses a 168-bit key. As a result, **3DES** is more secure than **DES**. It also requires more processing power, resulting in increased latency and decreased throughput. Select **NULL** to set up a tunnel without encryption. When you select **NULL**, you do not enter an encryption key.
Encapsulation Key (only with ESP)	With **DES**, type a unique key 8 characters long. With **3DES**, type a unique key 24 characters long. Any characters may be used, including spaces, but trailing spaces are truncated.
Authentication Algorithm	Select **SHA1** or **MD5** from the drop-down list box. **MD5** (Message Digest 5) and **SHA1** (Secure Hash Algorithm) are hash algorithms used to authenticate packet data. The **SHA1** algorithm is generally considered stronger than **MD5**, but is slower. Select **MD5** for minimal security and **SHA-1** for maximum security.
Authentication Key	Type a unique authentication key to be used by IPSec if applicable. Enter 16 characters for **MD5** authentication or 20 characters for **SHA-1** authentication. Any characters may be used, including spaces, but trailing spaces are truncated.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.

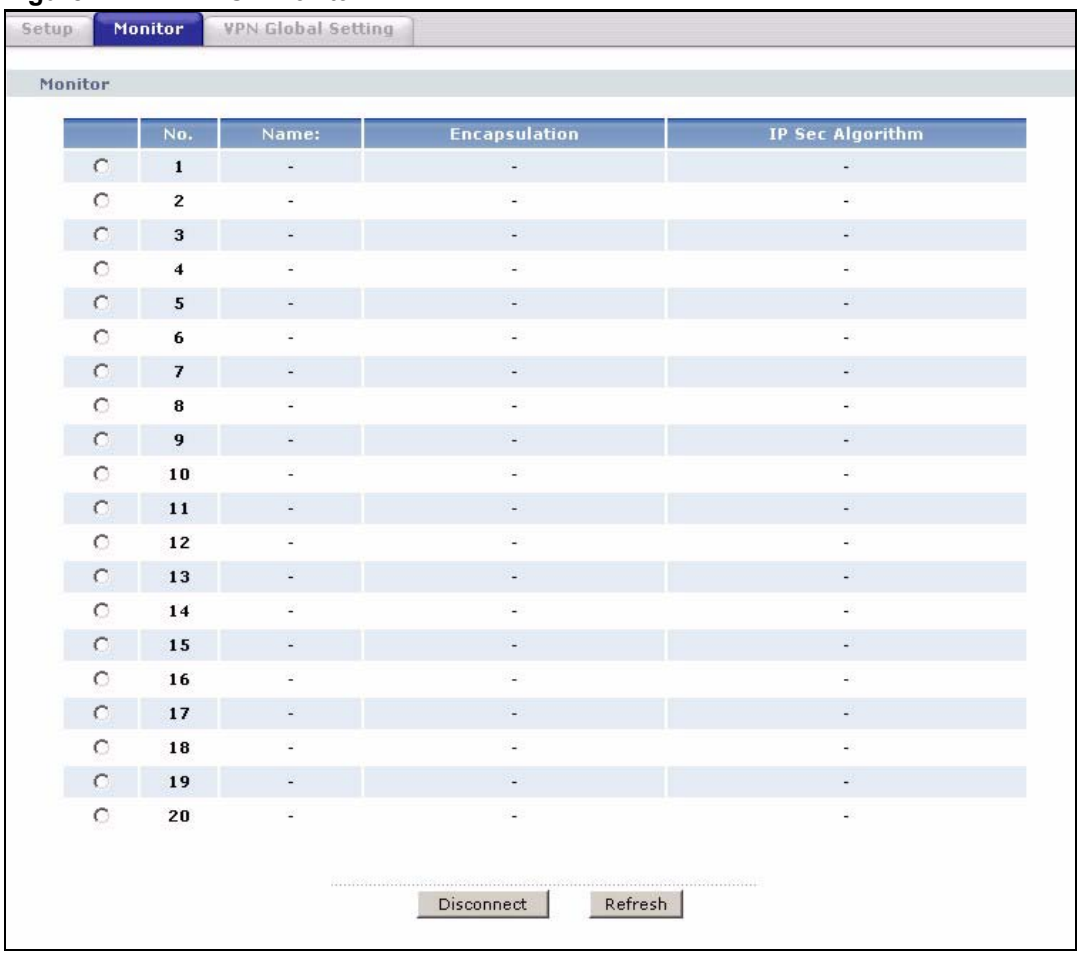
14.16 Viewing SA Monitor

Click **Security** > **VPN** > **Monitor** to open the screen as shown. Use this screen to display and manage active VPN connections.

A Security Association (SA) is the group of security settings related to a specific VPN tunnel. This screen displays active VPN connections. Use **Refresh** to display active VPN connections. This screen is read-only. The following table describes the fields in this tab.

When there is outbound traffic but no inbound traffic, the SA times out automatically after two minutes. A tunnel with no outbound or inbound traffic is "idle" and does not timeout until the SA lifetime period expires. See Section 14.6 on page 189on keep alive to have the ZyXEL Device renegotiate an IPSec SA when the SA lifetime expires, even if there is no traffic.

Figure 114 VPN: SA Monitor



The following table describes the fields in this screen.

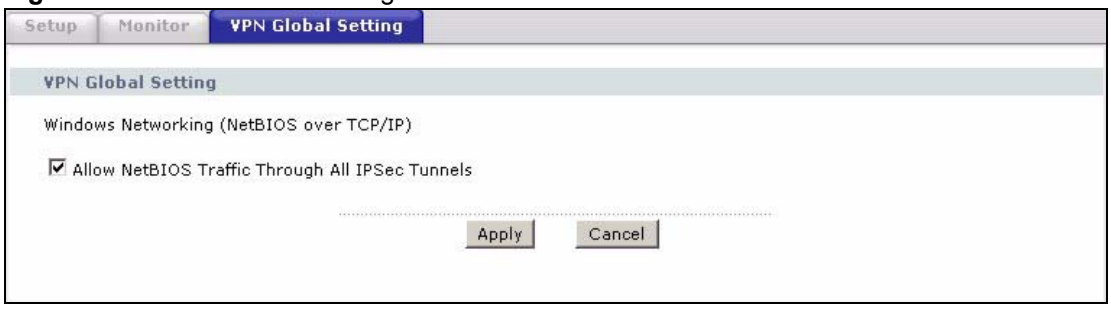
Table 80 VPN: SA Monitor

LABEL	DESCRIPTION
No	This is the security association index number.
Name	This field displays the identification name for this VPN policy.
Encapsulation	This field displays **Tunnel** or **Transport** mode.
IPSec Algorithm	This field displays the security protocol, encryption algorithm, and authentication algorithm used in each VPN tunnel.
Disconnect	Select one of the security associations, and then click **Disconnect** to stop that security association.
Refresh	Click **Refresh** to display the current active VPN connection(s).

14.17 Configuring Global Setting

To change your ZyXEL Device's global settings, click **VPN** > **VPN Global Setting**. The screen appears as shown.

Figure 115 VPN: Global Setting



The following table describes the fields in this screen.

Table 81 VPN: Global Setting

LABEL	DESCRIPTION
Windows Networking (NetBIOS over TCP/IP)	NetBIOS (Network Basic Input/Output System) are TCP or UDP packets that enable a computer to find other computers. It may sometimes be necessary to allow NetBIOS packets to pass through VPN tunnels in order to allow local computers to find computers on the remote network and vice versa.
Allow NetBIOS Traffic Through All IPSec Tunnels	Select this check box to send NetBIOS packets through the VPN connection.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

14.18 Telecommuter VPN/IPSec Examples

The following examples show how multiple telecommuters can make VPN connections to a single ZyXEL Device at headquarters. The telecommuters use IPSec routers with dynamic WAN IP addresses. The ZyXEL Device at headquarters has a static public IP address.

14.18.1 Telecommuters Sharing One VPN Rule Example

See the following figure and table for an example configuration that allows multiple telecommuters (A, B and C in the figure) to use one VPN rule to simultaneously access a ZyXEL Device at headquarters (HQ in the figure). The telecommuters do not have domain names mapped to the WAN IP addresses of their IPSec routers. The telecommuters must all use the same IPSec parameters but the local IP addresses (or ranges of addresses) should not overlap.

Figure 116 Telecommuters Sharing One VPN Rule Example

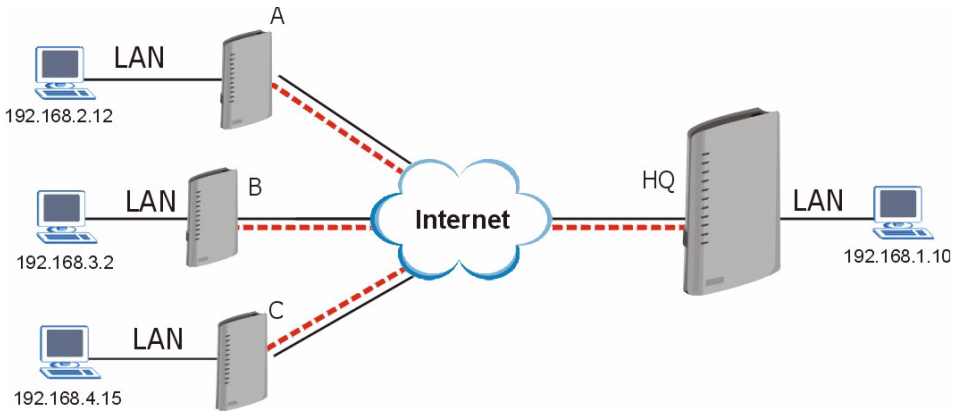


Table 82 Telecommuters Sharing One VPN Rule Example

FIELDS	TELECOMMUTERS	HEADQUARTERS
My IP Address:	0.0.0.0 (dynamic IP address assigned by the ISP)	Public static IP address
Secure Gateway IP Address:	Public static IP address	0.0.0.0 With this IP address only the telecommuter can initiate the IPSec tunnel.
Local IP Address:	Telecommuter A: 192.168.2.12 Telecommuter B: 192.168.3.2 Telecommuter C: 192.168.4.15	192.168.1.10
Remote IP Address:	192.168.1.10	0.0.0.0 (N/A)

14.18.2 Telecommuters Using Unique VPN Rules Example

In this example the telecommuters (A, B and C in the figure) use IPSec routers with domain names that are mapped to their dynamic WAN IP addresses (use Dynamic DNS to do this).

With aggressive negotiation mode (see Section 14.12.1 on page 199), the ZyXEL Device can use the ID types and contents to distinguish between VPN rules. Telecommuters can each use a separate VPN rule to simultaneously access a ZyXEL Device at headquarters. They can use different IPSec parameters. The local IP addresses (or ranges of addresses) of the rules configured on the ZyXEL Device at headquarters can overlap. The local IP addresses of the rules configured on the telecommuters' IPSec routers should not overlap.

See the following table and figure for an example where three telecommuters each use a different VPN rule for a VPN connection with a ZyXEL Device located at headquarters. The ZyXEL Device at headquarters (HQ in the figure) identifies each incoming SA by its ID type and content and uses the appropriate VPN rule to establish the VPN connection.

The ZyXEL Device at headquarters can also initiate VPN connections to the telecommuters since it can find the telecommuters by resolving their domain names.

Figure 117 Telecommuters Using Unique VPN Rules Example

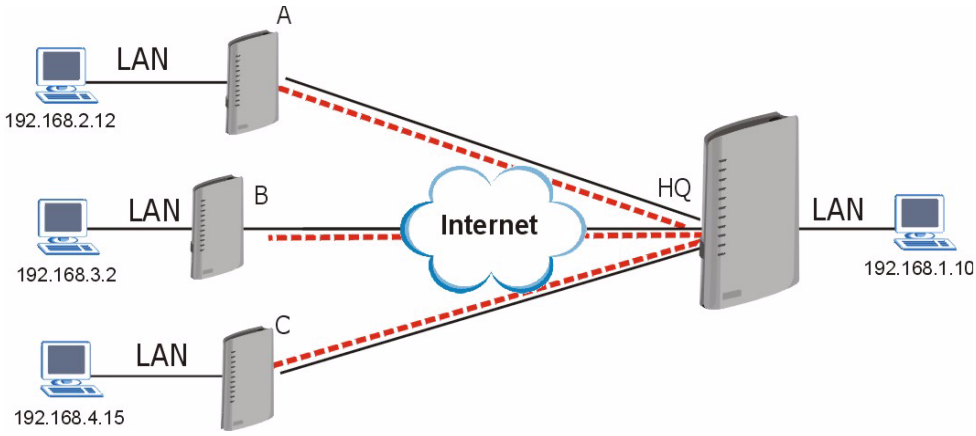


Table 83 Telecommuters Using Unique VPN Rules Example

TELECOMMUTERS	HEADQUARTERS
All Telecommuter Rules:	All Headquarters Rules:
My IP Address 0.0.0.0	My IP Address: bigcompanyhq.com
Secure Gateway Address: bigcompanyhq.com	Local IP Address: 192.168.1.10
Remote IP Address: 192.168.1.10	Local ID Type: E-mail
Peer ID Type: E-mail	Local ID Content: bob@bigcompanyhq.com
Peer ID Content: bob@bigcompanyhq.com	
Telecommuter A (telecommutera.dydns.org)	Headquarters ZyXEL Device Rule 1:
Local ID Type: IP	Peer ID Type: IP
Local ID Content: 192.168.2.12	Peer ID Content: 192.168.2.12
Local IP Address: 192.168.2.12	Secure Gateway Address: telecommuter1.com
	Remote Address 192.168.2.12
Telecommuter B (telecommuterb.dydns.org)	Headquarters ZyXEL Device Rule 2:
Local ID Type: DNS	Peer ID Type: DNS
Local ID Content: telecommuterb.com	Peer ID Content: telecommuterb.com
Local IP Address: 192.168.3.2	Secure Gateway Address: telecommuterb.com
	Remote Address 192.168.3.2
Telecommuter C (telecommuterc.dydns.org)	Headquarters ZyXEL Device Rule 3:
Local ID Type: E-mail	Peer ID Type: E-mail
Local ID Content: myVPN@myplace.com	Peer ID Content: myVPN@myplace.com
Local IP Address: 192.168.4.15	Secure Gateway Address: telecommuterc.com
	Remote Address 192.168.4.15

14.19 VPN and Remote Management

If a VPN tunnel uses Telnet, FTP, WWW, then you should configure remote management (**Remote Management**) to allow access for that service.

15

Certificates

This chapter gives background information about public-key certificates and explains how to use them.

15.1 Certificates Overview

The ZyXEL Device can use certificates (also called digital IDs) to authenticate users. Certificates are based on public-private key pairs. A certificate contains the certificate owner's identity and public key. Certificates provide a way to exchange public keys for use in authentication.

A Certification Authority (CA) issues certificates and guarantees the identity of each certificate owner. There are commercial certification authorities like CyberTrust or VeriSign and government certification authorities. You can use the ZyXEL Device to generate certification requests that contain identifying information and public keys and then send the certification requests to a certification authority.

In public-key encryption and decryption, each host has two keys. One key is public and can be made openly available; the other key is private and must be kept secure. Public-key encryption in general works as follows.

1. Tim wants to send a private message to Jenny. Tim generates a public key pair. What is encrypted with one key can only be decrypted using the other.
2. Tim keeps the private key and makes the public key openly available.
3. Tim uses his private key to encrypt the message and sends it to Jenny.
4. Jenny receives the message and uses Tim's public key to decrypt it.
5. Additionally, Jenny uses her own private key to encrypt a message and Tim uses Jenny's public key to decrypt the message.

The ZyXEL Device uses certificates based on public-key cryptology to authenticate users attempting to establish a connection, not to encrypt the data that you send after establishing a connection. The method used to secure the data that you send through an established connection depends on the type of connection. For example, a VPN tunnel might use the triple DES encryption algorithm.

The certification authority uses its private key to sign certificates. Anyone can then use the certification authority's public key to verify the certificates.

A certification path is the hierarchy of certification authority certificates that validate a certificate. The ZyXEL Device does not trust a certificate if any certificate on its path has expired or been revoked.

Certification authorities maintain directory servers with databases of valid and revoked certificates. A directory of certificates that have been revoked before the scheduled expiration is called a CRL (Certificate Revocation List). The ZyXEL Device can check a peer's certificate against a directory server's list of revoked certificates. The framework of servers, software, procedures and policies that handles keys is called PKI (Public-Key Infrastructure).

15.1.1 Advantages of Certificates

Certificates offer the following benefits.

- The ZyXEL Device only has to store the certificates of the certification authorities that you decide to trust, no matter how many devices you need to authenticate.
- Key distribution is simple and very secure since you can freely distribute public keys and you never need to transmit private keys.

15.2 Self-signed Certificates

You can have the ZyXEL Device act as a certification authority and sign its own certificates.

15.3 Configuration Summary

This section summarizes how to manage certificates on the ZyXEL Device.

Figure 118 Certificate Configuration Overview

Use the **My Certificates** screens to generate and export self-signed certificates or certification requests and import the ZyXEL Device's CA-signed certificates.

Use the **Trusted CAs** screens to save CA certificates to the ZyXEL Device.

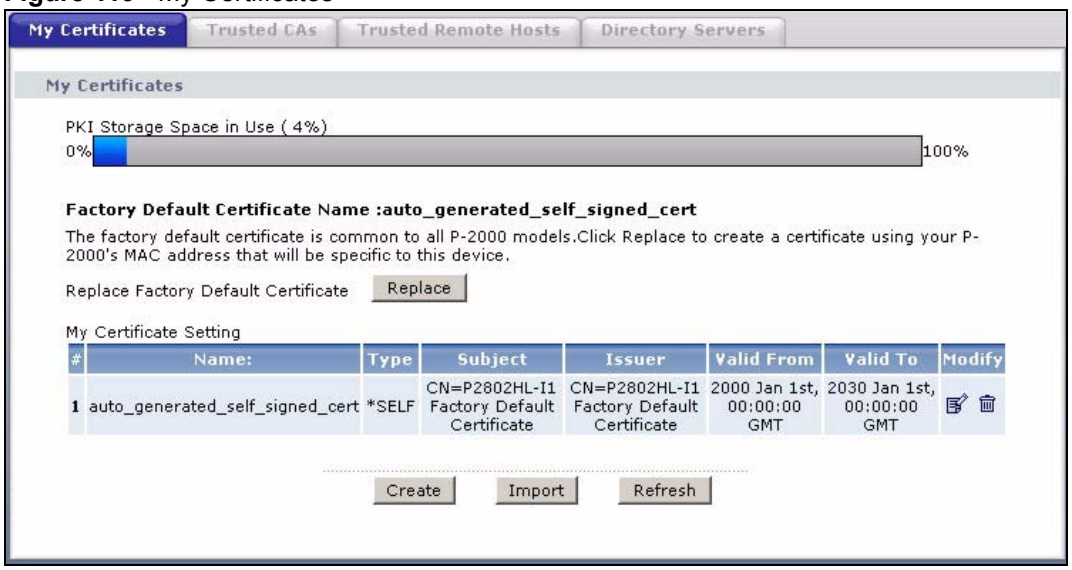
Use the **Trusted Remote Hosts** screens to import self-signed certificates.

Use the **Directory Servers** screen to configure a list of addresses of directory servers (that contain lists of valid and revoked certificates).

15.4 My Certificates

Click **Security > Certificates > My Certificates** to open the **My Certificates** screen. This is the ZyXEL Device's summary list of certificates and certification requests. Certificates display in black and certification requests display in gray.

Figure 119 My Certificates


My Certificates
Trusted CAs
Trusted Remote Hosts
Directory Servers
My Certificates
PKI Storage Space in Use (4%)
0%
100%
Factory Default Certificate Name :auto_generated_self_signed_cert
The factory default certificate is common to all P-2000 models.Click Replace to create a certificate using your P-2000's MAC address that will be specific to this device.
Replace Factory Default Certificate
Replace
My Certificate Setting
Name: Type Subject Issuer Valid From Valid To Modify
1 auto_generated_self_signed_cert *SELF CN=P2802HL-I1 Factory Default Certificate CN=P2802HL-I1 Factory Default Certificate 2000 Jan 1st, 00:00:00 GMT 2030 Jan 1st, 00:00:00 GMT
Create
Import
Refresh

The following table describes the labels in this screen.

Table 84 My Certificates

LABEL	DESCRIPTION
PKI Storage Space in Use	This bar displays the percentage of the ZyXEL Device's PKI storage space that is currently in use. The bar turns from green to red when the maximum is being approached. When the bar is red, you should consider deleting expired or unnecessary certificates before adding more certificates.
Replace	This button displays when the ZyXEL Device has the factory default certificate. The factory default certificate is common to all ZyXEL Devices that use certificates. ZyXEL recommends that you use this button to replace the factory default certificate with one that uses your ZyXEL Device's MAC address.
#	This field displays the certificate index number. The certificates are listed in alphabetical order.
Name	This field displays the name used to identify this certificate. It is recommended that you give each certificate a unique name.
Type	This field displays what kind of certificate this is. **REQ** represents a certification request and is not yet a valid certificate. Send a certification request to a certification authority, which then issues a certificate. Use the **My Certificate Import** screen to import the certificate and replace the request. **SELF** represents a self-signed certificate. ***SELF** represents the default self-signed certificate, which the ZyXEL Device uses to sign imported trusted remote host certificates. **CERT** represents a certificate issued by a certification authority.
Subject	This field displays identifying information about the certificate's owner, such as CN (Common Name), OU (Organizational Unit or department), O (Organization or company) and C (Country). It is recommended that each certificate have unique subject information.
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as a common name, organizational unit or department, organization or company and country. With self-signed certificates, this is the same information as in the **Subject** field.
Valid From	This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable.

Table 84 My Certificates (continued)

LABEL	DESCRIPTION
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expiring! or Expired! message if the certificate is about to expire or has already expired.
Modify	Click the Edit icon to open a screen with an in-depth list of information about the certificate. Click the Remove icon to remove the certificate. A window displays asking you to confirm that you want to delete the certificate. You cannot delete a certificate that one or more features is configured to use. Do the following to delete a certificate that shows ***SELF** in the **Type** field. 1. Make sure that no other features, such as HTTPS, VPN, SSH are configured to use the ***SELF** certificate. 2. Click the Edit icon next to another self-signed certificate (see the description on the **Create** button if you need to create a self-signed certificate). 3. Select the **Default self-signed certificate which signs the imported remote host certificates** check box. 4. Click **Apply** to save the changes and return to the **My Certificates** screen. 5. The certificate that originally showed ***SELF** displays **SELF** and you can delete it now. Note that subsequent certificates move up by one when you take this action
Create	Click **Create** to go to the screen where you can have the ZyXEL Device generate a certificate or a certification request.
Import	Click **Import** to open a screen where you can save the certificate that you have enrolled from a certification authority from your computer to the ZyXEL Device.
Refresh	Click **Refresh** to display the current validity status of the certificates.

15.5 My Certificate Import

Click **Security > Certificates > My Certificates** and then **Import** to open the **My Certificate Import** screen. Follow the instructions in this screen to save an existing certificate to the ZyXEL Device.

You can only import a certificate that matches a corresponding certification request that was generated by the ZyXEL Device.

The certificate you import replaces the corresponding request in the **My Certificates** screen.

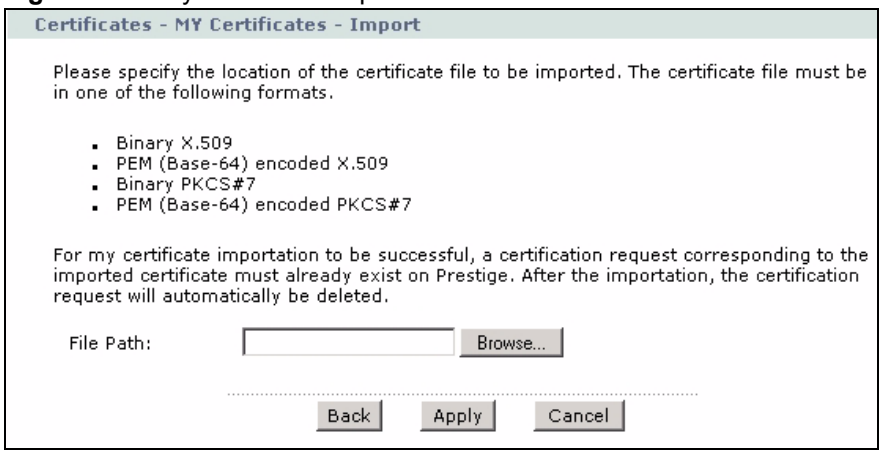
You must remove any spaces from the certificate's filename before you can import it.

15.5.1 Certificate File Formats

The certification authority certificate that you want to import has to be in one of these file formats:

- Binary X.509: This is an ITU-T recommendation that defines the formats for X.509 certificates.
- PEM (Base-64) encoded X.509: This Privacy Enhanced Mail format uses 64 ASCII characters to convert a binary X.509 certificate into a printable form.
- Binary PKCS#7: This is a standard that defines the general syntax for data (including digital signatures) that may be encrypted. The ZyXEL Device currently allows the importation of a PKS#7 file that contains a single certificate.
- PEM (Base-64) encoded PKCS#7: This Privacy Enhanced Mail (PEM) format uses 64 ASCII characters to convert a binary PKCS#7 certificate into a printable form.

Figure 120 My Certificate Import


Certificates - MY Certificates - Import
Please specify the location of the certificate file to be imported. The certificate file must be in one of the following formats.
Binary X.509
PEM (Base-64) encoded X.509
Binary PKCS#7
PEM (Base-64) encoded PKCS#7
For my certificate importation to be successful, a certification request corresponding to the imported certificate must already exist on Prestige. After the importation, the certification request will automatically be deleted.
File Path:
Browse...
Back
Apply
Cancel

The following table describes the labels in this screen.

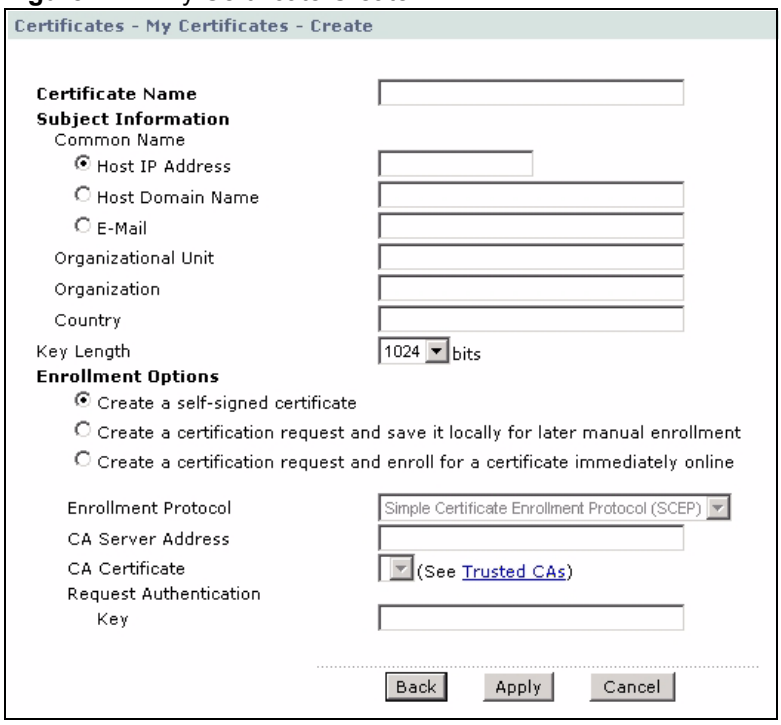
Table 85 My Certificate Import

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse** to find it.
Browse	Click **Browse** to find the certificate file you want to upload.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save the certificate on the ZyXEL Device.
Cancel	Click **Cancel** to clear your settings.

15.6 My Certificate Create

Click **Security** > **Certificates** > **My Certificates** > **Create** to open the **My Certificate Create** screen. Use this screen to have the ZyXEL Device create a self-signed certificate, enroll a certificate with a certification authority or generate a certification request.

Figure 121 My Certificate Create



The following table describes the labels in this screen.

Table 86 My Certificate Create

LABEL	DESCRIPTION
Certificate Name	Type up to 31 ASCII characters (not including spaces) to identify this certificate.
Subject Information	Use these fields to record information that identifies the owner of the certificate. You do not have to fill in every field, although the **Common Name** is mandatory. The certification authority may add fields (such as a serial number) to the subject information when it issues a certificate. It is recommended that each certificate have unique subject information.
Common Name	Select a radio button to identify the certificate's owner by IP address, domain name or e-mail address. Type the IP address (in dotted decimal notation), domain name or e-mail address in the field provided. The domain name or e-mail address can be up to 31 ASCII characters. The domain name or e-mail address is for identification purposes only and can be any string.
Organizational Unit	Type up to 127 characters to identify the organizational unit or department to which the certificate owner belongs. You may use any character, including spaces, but the ZyXEL Device drops trailing spaces.
Organization	Type up to 127 characters to identify the company or group to which the certificate owner belongs. You may use any character, including spaces, but the ZyXEL Device drops trailing spaces.

Table 86 My Certificate Create (continued)

LABEL	DESCRIPTION
Country	Type up to 127 characters to identify the nation where the certificate owner is located. You may use any character, including spaces, but the ZyXEL Device drops trailing spaces.
Key Length	Select a number from the drop-down list box to determine how many bits the key should use (512 to 2048). The longer the key, the more secure it is. A longer key also uses more PKI storage space.
Enrollment Options	These radio buttons deal with how and when the certificate is to be generated.
Create a self-signed certificate	Select **Create a self-signed certificate** to have the ZyXEL Device generate the certificate and act as the Certification Authority (CA) itself. This way you do not need to apply to a certification authority for certificates.
Create a certification request and save it locally for later manual enrollment	Select **Create a certification request and save it locally for later manual enrollment** to have the ZyXEL Device generate and store a request for a certificate. Use the **My Certificate Details** screen to view the certification request and copy it to send to the certification authority. Copy the certification request from the **My Certificate Details** screen (see Section 15.7 on page 218) and then send it to the certification authority.
Create a certification request and enroll for a certificate immediately online	Select **Create a certification request and enroll for a certificate immediately online** to have the ZyXEL Device generate a request for a certificate and apply to a certification authority for a certificate. You must have the certification authority's certificate already imported in the **Trusted CAs** screen. When you select this option, you must select the certification authority's enrollment protocol and the certification authority's certificate from the drop-down list boxes and enter the certification authority's server address. You also need to fill in the **Reference Number** and **Key** if the certification authority requires them.
Enrollment Protocol	Select the certification authority's enrollment protocol from the drop-down list box. **Simple Certificate Enrollment Protocol (SCEP)** is a TCP-based enrollment protocol that was developed by VeriSign and Cisco. **Certificate Management Protocol (CMP)** is a TCP-based enrollment protocol that was developed by the Public Key Infrastructure X.509 working group of the Internet Engineering Task Force (IETF) and is specified in RFC 2510.
CA Server Address	Enter the IP address (or URL) of the certification authority server.
CA Certificate	Select the certification authority's certificate from the **CA Certificate** drop-down list box. You must have the certification authority's certificate already imported in the **Trusted CAs** screen. Click **Trusted CAs** to go to the **Trusted CAs** screen where you can view (and manage) the ZyXEL Device's list of certificates of trusted certification authorities.
Request Authentication	When you select **Create a certification request and enroll for a certificate immediately online**, the certification authority may want you to include a reference number and key to identify you when you send a certification request. Fill in both the **Reference Number** and the **Key** fields if your certification authority uses CMP enrollment protocol. Just fill in the **Key** field if your certification authority uses the SCEP enrollment protocol.
Key	Type the key that the certification authority gave you.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to begin certificate or certification request generation.
Cancel	Click **Cancel** to quit and return to the **My Certificates** screen.

After you click **Apply** in the **My Certificate Create** screen, you see a screen that tells you the ZyXEL Device is generating the self-signed certificate or certification request.

After the ZyXEL Device successfully enrolls a certificate or generates a certification request or a self-signed certificate, you see a screen with a **Return** button that takes you back to the **My Certificates** screen.

If you configured the **My Certificate Create** screen to have the ZyXEL Device enroll a certificate and the certificate enrollment is not successful, you see a screen with a **Return** button that takes you back to the **My Certificate Create** screen. Click **Return** and check your information in the **My Certificate Create** screen. Make sure that the certification authority information is correct and that your Internet connection is working properly if you want the ZyXEL Device to enroll a certificate online.

15.7 My Certificate Details

Click **Security** > **Certificates** > **My Certificates** to open the **My Certificates** screen (see Figure 119 on page 213). Click the edit icon to open the **My Certificate Details** screen. Use this screen to view in-depth certificate information and change the certificate's name. In the case of a self-signed certificate, you can set it to be the one that the ZyXEL Device uses to sign the trusted remote host certificates that you import to the ZyXEL Device.

Figure 122 My Certificate Details

The following table describes the labels in this screen.

Table 87 My Certificate Details

LABEL	DESCRIPTION
Certificate Name	This field displays the identifying name of this certificate. If you want to change the name, type up to 31 characters to identify this certificate. You may use any character (not including spaces).
Property Default self-signed certificate which signs the imported remote host certificates.	Select this check box to have the ZyXEL Device use this certificate to sign the trusted remote host certificates that you import to the ZyXEL Device. This check box is only available with self-signed certificates. If this check box is already selected, you cannot clear it in this screen, you must select this check box in another self-signed certificate's details screen. This automatically clears the check box in the details screen of the certificate that was previously set to sign the imported trusted remote host certificates.
Certification Path	Click the **Refresh** button to have this read-only text box display the hierarchy of certification authorities that validate the certificate (and the certificate itself). If the issuing certification authority is one that you have imported as a trusted certification authority, it may be the only certification authority in the list (along with the certificate itself). If the certificate is a self-signed certificate, the certificate itself is the only one in the list. The ZyXEL Device does not trust the certificate and displays "Not trusted" in this field if any certificate on the path has expired or been revoked.
Refresh	Click **Refresh** to display the certification path.
Certificate Information	These read-only fields display detailed information about the certificate.
Type	This field displays general information about the certificate. CA-signed means that a Certification Authority signed the certificate. Self-signed means that the certificate's owner signed the certificate (not a certification authority). "X.509" means that this certificate was created and signed according to the ITU-T X.509 recommendation that defines the formats for public-key certificates.
Version	This field displays the X.509 version number.
Serial Number	This field displays the certificate's identification number given by the certification authority or generated by the ZyXEL Device.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organizational Unit (OU), Organization (O) and Country (C).
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as Common Name, Organizational Unit, Organization and Country. With self-signed certificates, this is the same as the **Subject Name** field.
Signature Algorithm	This field displays the type of algorithm that was used to sign the certificate. The ZyXEL Device uses rsa-pkcs1-sha1 (RSA public-private key encryption algorithm and the SHA1 hash algorithm). Some certification authorities may use rsa-pkcs1-md5 (RSA public-private key encryption algorithm and the MD5 hash algorithm).
Valid From	This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expiring! or Expired! message if the certificate is about to expire or has already expired.
Key Algorithm	This field displays the type of algorithm that was used to generate the certificate's key pair (the ZyXEL Device uses RSA encryption) and the length of the key set in bits (1024 bits for example).

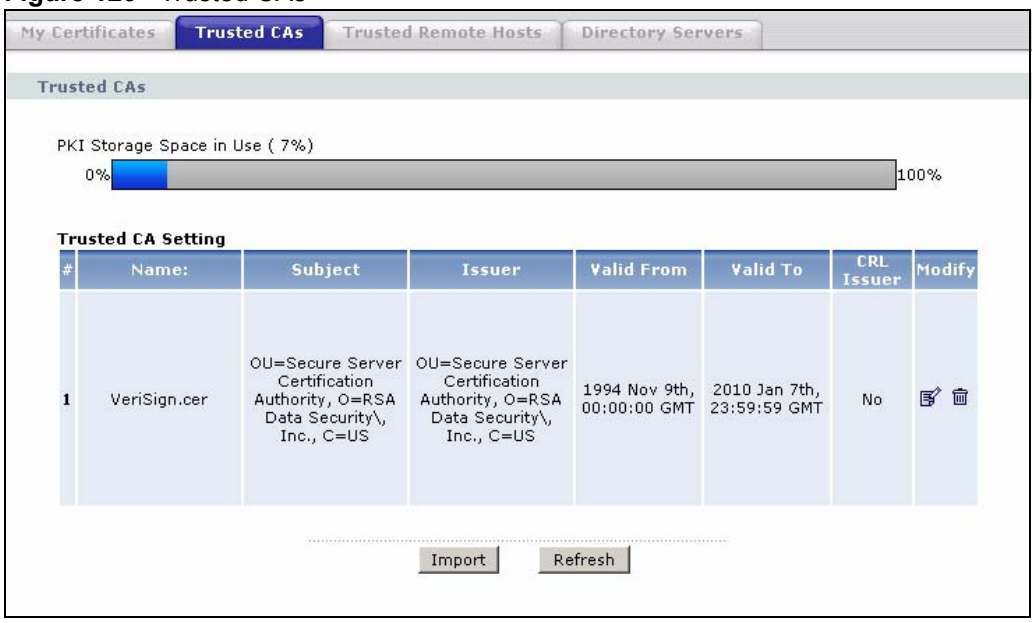
Table 87 My Certificate Details (continued)

LABEL	DESCRIPTION
Subject Alternative Name	This field displays the certificate owner's IP address (IP), domain name (DNS) or e-mail address (EMAIL).
Key Usage	This field displays for what functions the certificate's key can be used. For example, "DigitalSignature" means that the key can be used to sign certificates and "KeyEncipherment" means that the key can be used to encrypt text.
Basic Constraint	This field displays general information about the certificate. For example, Subject Type=CA means that this is a certification authority's certificate and "Path Length Constraint=1" means that there can only be one certification authority in the certificate's path.
MD5 Fingerprint	This is the certificate's message digest that the ZyXEL Device calculated using the MD5 algorithm.
SHA1 Fingerprint	This is the certificate's message digest that the ZyXEL Device calculated using the SHA1 algorithm.
Certificate in PEM (Base-64) Encoded Format	This read-only text box displays the certificate or certification request in Privacy Enhanced Mail (PEM) format. PEM uses 64 ASCII characters to convert the binary certificate into a printable form. You can copy and paste a certification request into a certification authority's web page, an e-mail that you send to the certification authority or a text editor and save the file on a management computer for later manual enrollment. You can copy and paste a certificate into an e-mail to send to friends or colleagues or you can copy and paste a certificate into a text editor and save the file on a management computer for later distribution (via floppy disk for example).
Back	Click **Back** to return to the previous screen.
Export	Click this button and then **Save** in the **File Download** screen. The **Save As** screen opens, browse to the location that you want to use and click **Save**.
Apply	Click **Apply** to save your changes back to the ZyXEL Device. You can only change the name, except in the case of a self-signed certificate, which you can also set to be the default self-signed certificate that signs the imported trusted remote host certificates.
Cancel	Click **Cancel** to quit and return to the **My Certificates** screen.

15.8 Trusted CAs

Click **Security > Certificates > Trusted CAs** to open the **Trusted CAs** screen. This screen displays a summary list of certificates of the certification authorities that you have set the ZyXEL Device to accept as trusted. The ZyXEL Device accepts any valid certificate signed by a certification authority on this list as being trustworthy; thus you do not need to import any certificate that is signed by one of these certification authorities.

Figure 123 Trusted CAs



The following table describes the labels in this screen.

Table 88 Trusted CAs

LABEL	DESCRIPTION
PKI Storage Space in Use	This bar displays the percentage of the ZyXEL Device's PKI storage space that is currently in use. The bar turns from blue to red when the maximum is being approached. When the bar is red, you should consider deleting expired or unnecessary certificates before adding more certificates.
#	This field displays the certificate index number. The certificates are listed in alphabetical order.
Name	This field displays the name used to identify this certificate.
Subject	This field displays identifying information about the certificate's owner, such as CN (Common Name), OU (Organizational Unit or department), O (Organization or company) and C (Country). It is recommended that each certificate have unique subject information.
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as a common name, organizational unit or department, organization or company and country. With self-signed certificates, this is the same information as in the **Subject** field.
Valid From	This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expiring! or Expired! message if the certificate is about to expire or has already expired.
CRL Issuer	This field displays Yes if the certification authority issues Certificate Revocation Lists for the certificates that it has issued and you have selected the **Issues certificate revocation lists (CRL)** check box in the certificate's details screen to have the ZyXEL Device check the CRL before trusting any certificates issued by the certification authority. Otherwise the field displays "No".

Table 88 Trusted CAs (continued)

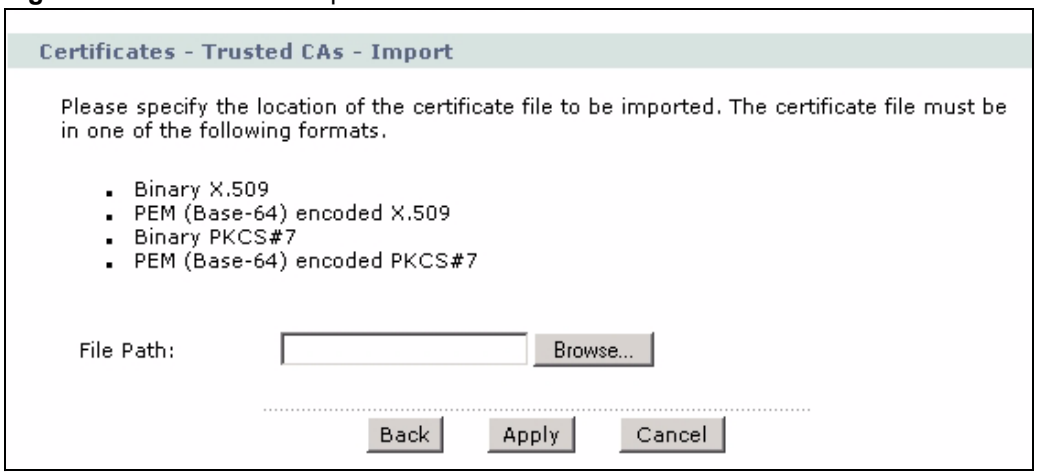
LABEL	DESCRIPTION
Modify	Click the Edit icon to open a screen with an in-depth list of information about the certificate. Click the Remove icon to remove the certificate. A window displays asking you to confirm that you want to delete the certificates. Note that subsequent certificates move up by one when you take this action.
Import	Click **Import** to open a screen where you can save the certificate of a certification authority that you trust, from your computer to the ZyXEL Device.
Refresh	Click this button to display the current validity status of the certificates.

15.9 Trusted CA Import

Click **Security** > **Certificates** > **Trusted CAs** to open the **Trusted CAs** screen and then click **Import** to open the **Trusted CA Import** screen. Follow the instructions in this screen to save a trusted certification authority's certificate to the ZyXEL Device.

You must remove any spaces from the certificate's filename before you can import the certificate.

Figure 124 Trusted CA Import


Certificates - Trusted CAs - Import
Please specify the location of the certificate file to be imported. The certificate file must be in one of the following formats.
Binary X.509
PEM (Base-64) encoded X.509
Binary PKCS#7
PEM (Base-64) encoded PKCS#7
File Path:
Browse...
Back
Apply
Cancel

The following table describes the labels in this screen.

Table 89 Trusted CA Import

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse** to find it.
Browse	Click **Browse** to find the certificate file you want to upload.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save the certificate on the ZyXEL Device.
Cancel	Click **Cancel** to quit and return to the **Trusted CAs** screen.

15.10 Trusted CA Details

Click **Security** > **Certificates** > **Trusted CAs** to open the **Trusted CAs** screen. Click the details icon to open the **Trusted CA Details** screen. Use this screen to view in-depth information about the certification authority's certificate, change the certificate's name and set whether or not you want the ZyXEL Device to check a certification authority's list of revoked certificates before trusting a certificate issued by the certification authority.

Figure 125 Trusted CA Details

The following table describes the labels in this screen.

Table 90 Trusted CA Details

LABEL	DESCRIPTION
Certificate Name	This field displays the identifying name of this certificate. If you want to change the name, type up to 31 characters to identify this key certificate. You may use any character (not including spaces).
Property Issues certificate revocation lists (CRLs)	Select this check box to have the ZyXEL Device check incoming certificates that are issued by this certification authority against a Certificate Revocation List (CRL). Clear this check box to have the ZyXEL Device not check incoming certificates that are issued by this certification authority against a Certificate Revocation List (CRL).
Certification Path	Click the **Refresh** button to have this read-only text box display the end entity's certificate and a list of certification authority certificates that shows the hierarchy of certification authorities that validate the end entity's certificate. If the issuing certification authority is one that you have imported as a trusted certification authority, it may be the only certification authority in the list (along with the end entity's own certificate). The ZyXEL Device does not trust the end entity's certificate and displays "Not trusted" in this field if any certificate on the path has expired or been revoked.
Refresh	Click **Refresh** to display the certification path.
Certificate Information	These read-only fields display detailed information about the certificate.
Type	This field displays general information about the certificate. CA-signed means that a Certification Authority signed the certificate. Self-signed means that the certificate's owner signed the certificate (not a certification authority). X.509 means that this certificate was created and signed according to the ITU-T X.509 recommendation that defines the formats for public-key certificates.
Version	This field displays the X.509 version number.
Serial Number	This field displays the certificate's identification number given by the certification authority.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organizational Unit (OU), Organization (O) and Country (C).
Issuer	This field displays identifying information about the certificate's issuing certification authority, such as Common Name, Organizational Unit, Organization and Country. With self-signed certificates, this is the same information as in the **Subject Name** field.
Signature Algorithm	This field displays the type of algorithm that was used to sign the certificate. Some certification authorities use rsa-pkcs1-sha1 (RSA public-private key encryption algorithm and the SHA1 hash algorithm). Other certification authorities may use rsa-pkcs1-md5 (RSA public-private key encryption algorithm and the MD5 hash algorithm).
Valid From	This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expiring! or Expired! message if the certificate is about to expire or has already expired.
Key Algorithm	This field displays the type of algorithm that was used to generate the certificate's key pair (the ZyXEL Device uses RSA encryption) and the length of the key set in bits (1024 bits for example).

Table 90 Trusted CA Details (continued)

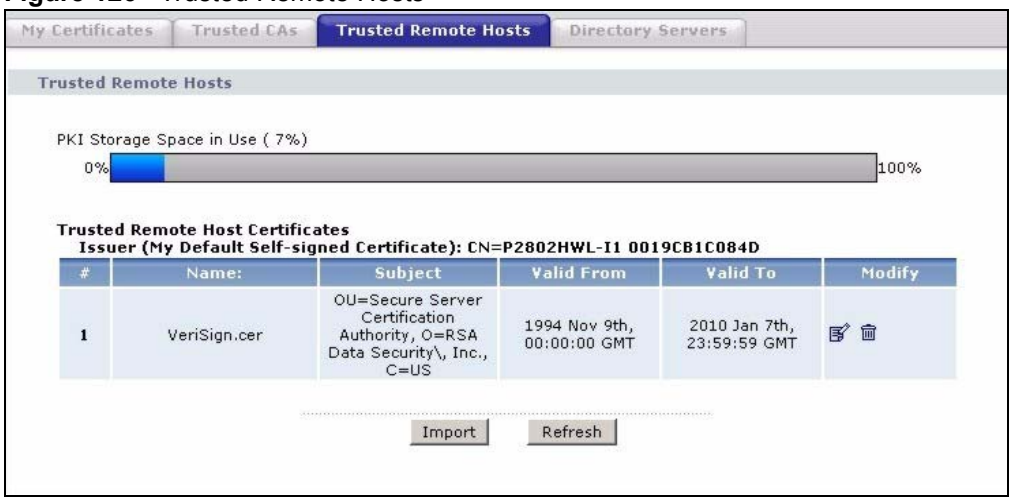
LABEL	DESCRIPTION
Subject Alternative Name	This field displays the certificate's owner's IP address (IP), domain name (DNS) or e-mail address (EMAIL).
Key Usage	This field displays for what functions the certificate's key can be used. For example, "DigitalSignature" means that the key can be used to sign certificates and "KeyEncipherment" means that the key can be used to encrypt text.
Basic Constraint	This field displays general information about the certificate. For example, Subject Type=CA means that this is a certification authority's certificate and "Path Length Constraint=1" means that there can only be one certification authority in the certificate's path.
CRL Distribution Points	This field displays how many directory servers with Lists of revoked certificates the issuing certification authority of this certificate makes available. This field also displays the domain names or IP addresses of the servers.
MD5 Fingerprint	This is the certificate's message digest that the ZyXEL Device calculated using the MD5 algorithm. You can use this value to verify with the certification authority (over the phone for example) that this is actually their certificate.
SHA1 Fingerprint	This is the certificate's message digest that the ZyXEL Device calculated using the SHA1 algorithm. You can use this value to verify with the certification authority (over the phone for example) that this is actually their certificate.
Certificate in PEM (Base-64) Encoded Format	This read-only text box displays the certificate or certification request in Privacy Enhanced Mail (PEM) format. PEM uses 64 ASCII characters to convert the binary certificate into a printable form. You can copy and paste the certificate into an e-mail to send to friends or colleagues or you can copy and paste the certificate into a text editor and save the file on a management computer for later distribution (via floppy disk for example).
Back	Click **Back** to return to the previous screen.
Export	Click this button and then **Save** in the **File Download** screen. The **Save As** screen opens, browse to the location that you want to use and click **Save**.
Apply	Click **Apply** to save your changes back to the ZyXEL Device. You can only change the name and/or set whether or not you want the ZyXEL Device to check the CRL that the certification authority issues before trusting a certificate issued by the certification authority.
Cancel	Click **Cancel** to quit and return to the **Trusted CAs** screen.

15.11 Trusted Remote Hosts

Click **Security > Certificates > Trusted Remote Hosts** to open the **Trusted Remote Hosts** screen. This screen displays a list of the certificates of peers that you trust but which are not signed by one of the certification authorities on the **Trusted CAs** screen.

You do not need to add any certificate that is signed by one of the certification authorities on the **Trusted CAs** screen since the ZyXEL Device automatically accepts any valid certificate signed by a trusted certification authority as being trustworthy.

Figure 126 Trusted Remote Hosts


My Certificates
Trusted CAs
Trusted Remote Hosts
Directory Servers
Trusted Remote Hosts
PKI Storage Space in Use (7%)
0%
100%
Trusted Remote Host Certificates
Issuer (My Default Self-signed Certificate): CN=P2802HWL-I1 0019CB1C084D
Name: Subject Valid From Valid To Modify
1 VeriSign.cer OU=Secure Server Certification Authority, O=RSA Data Security\, Inc., C=US 1994 Nov 9th, 00:00:00 GMT 2010 Jan 7th, 23:59:59 GMT
Import
Refresh

The following table describes the labels in this screen.

Table 91 Trusted Remote Hosts

LABEL	DESCRIPTION
PKI Storage Space in Use	This bar displays the percentage of the ZyXEL Device's PKI storage space that is currently in use. The bar turns from green to red when the maximum is being approached. When the bar is red, you should consider deleting expired or unnecessary certificates before adding more certificates.
Issuer (My Default Self-signed Certificate)	This field displays identifying information about the default self-signed certificate on the ZyXEL Device that the ZyXEL Device uses to sign the trusted remote host certificates.
#	This field displays the certificate index number. The certificates are listed in alphabetical order.
Name	This field displays the name used to identify this certificate.
Subject	This field displays identifying information about the certificate's owner, such as CN (Common Name), OU (Organizational Unit or department), O (Organization or company) and C (Country). It is recommended that each certificate have unique subject information.
Valid From	This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expiring! or Expired! message if the certificate is about to expire or has already expired.
Modify	Click the Edit icon to open a screen with an in-depth list of information about the certificate. Click the Remove icon to remove the certificate. A window displays asking you to confirm that you want to delete the certificate. Note that subsequent certificates move up by one when you take this action.
Import	Click **Import** to open a screen where you can save the certificate of a remote host (which you trust) from your computer to the ZyXEL Device.
Refresh	Click this button to display the current validity status of the certificates.

15.12 Verifying a Trusted Remote Host's Certificate

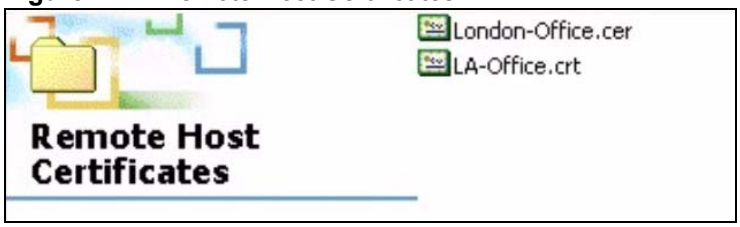
Certificates issued by certification authorities have the certification authority's signature for you to check. Self-signed certificates only have the signature of the host itself. This means that you must be very careful when deciding to import (and thereby trust) a remote host's self-signed certificate.

15.12.1 Trusted Remote Host Certificate Fingerprints

A certificate's fingerprints are message digests calculated using the MD5 or SHA1 algorithms. The following procedure describes how to use a certificate's fingerprint to verify that you have the remote host's actual certificate.

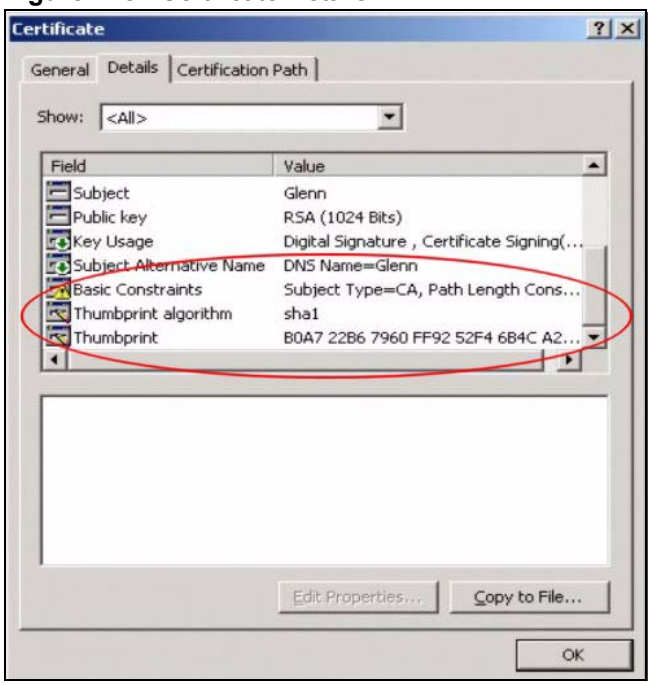
1. Browse to where you have the remote host's certificate saved on your computer.
2. Make sure that the certificate has a ".cer" or ".crt" file name extension.

Figure 127 Remote Host Certificates



3. Double-click the certificate's icon to open the **Certificate** window. Click the **Details** tab and scroll down to the **Thumbprint Algorithm** and **Thumbprint** fields.

Figure 128 Certificate Details



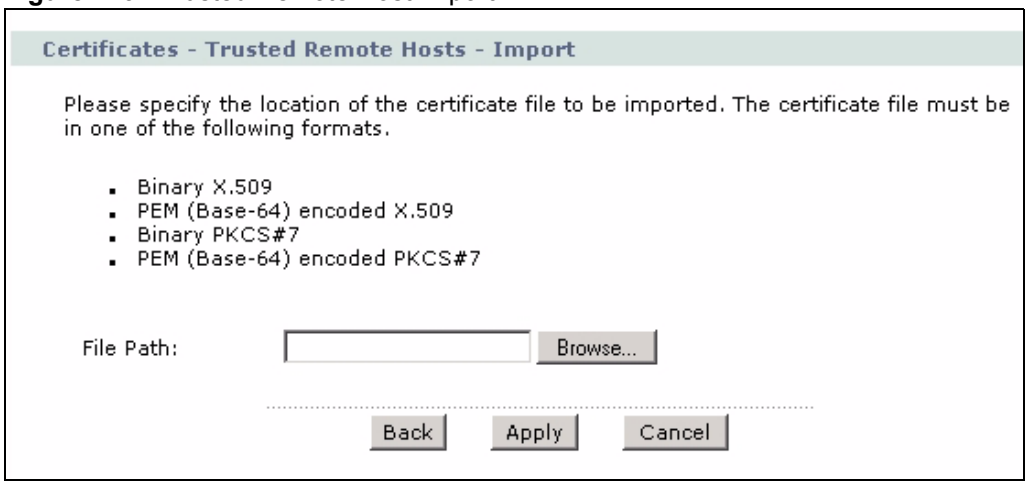
Verify (over the phone for example) that the remote host has the same information in the **Thumbprint Algorithm** and **Thumbprint** fields.

15.13 Trusted Remote Hosts Import

Click **Security** > **Certificates** > **Trusted Remote Hosts** to open the **Trusted Remote Hosts** screen and then click **Import** to open the **Trusted Remote Host Import** screen. Follow the instructions in this screen to save a trusted host's certificate to the ZyXEL Device.

The trusted remote host certificate must be a self-signed certificate; and you must remove any spaces from its filename before you can import it.

Figure 129 Trusted Remote Host Import


Certificates - Trusted Remote Hosts - Import
Please specify the location of the certificate file to be imported. The certificate file must be in one of the following formats.
Binary X.509
PEM (Base-64) encoded X.509
Binary PKCS#7
PEM (Base-64) encoded PKCS#7
File Path:
Browse...
Back
Apply
Cancel

The following table describes the labels in this screen.

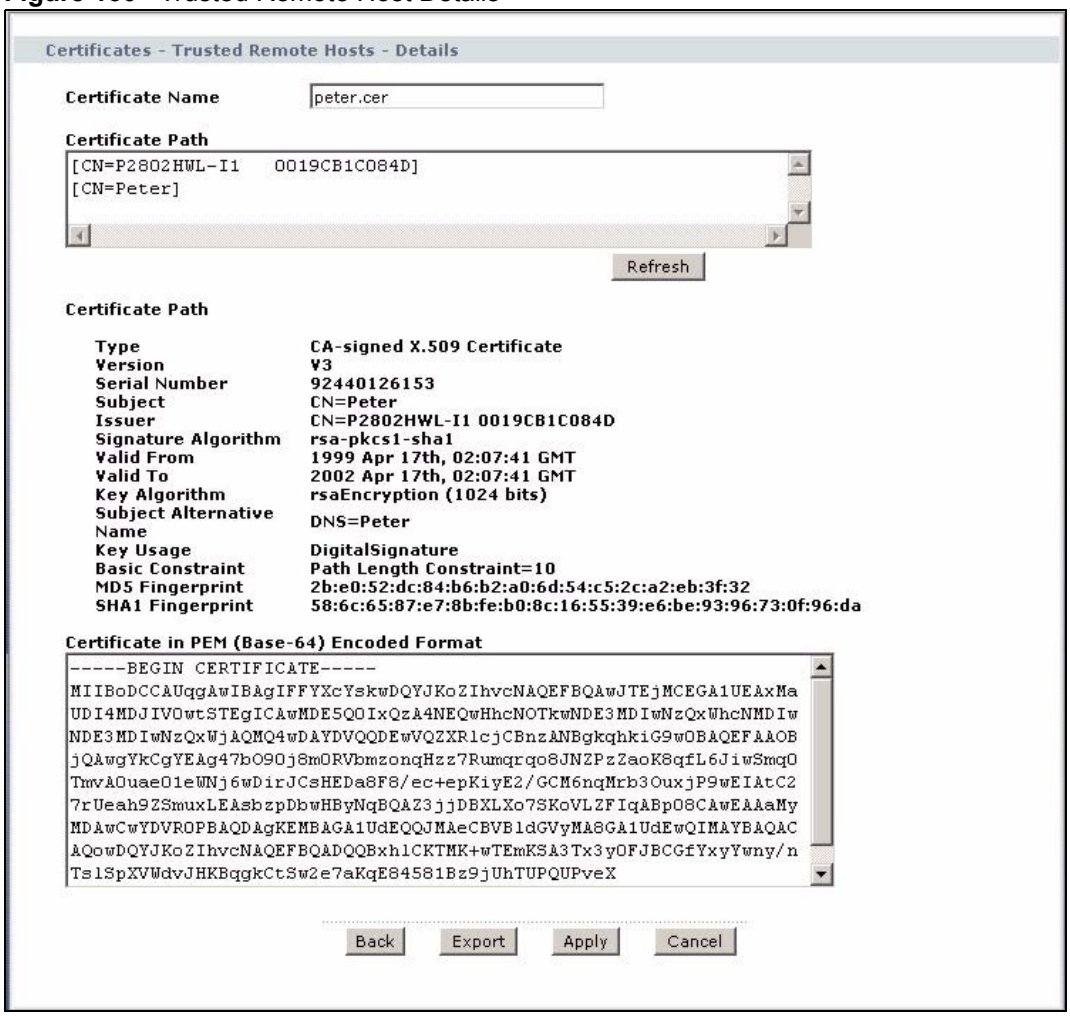
Table 92 Trusted Remote Host Import

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse** to find it.
Browse	Click **Browse** to find the certificate file you want to upload.
Back	Click **Back** to return to the previous screen.
Apply	Click **Apply** to save the certificate on the ZyXEL Device.
Cancel	Click **Cancel** to quit and return to the **Trusted Remote Hosts** screen.

15.14 Trusted Remote Host Certificate Details

Click **Security** > **Certificates** > **Trusted Remote Hosts** to open the **Trusted Remote Hosts** screen. Click the details icon to open the **Trusted Remote Host Details** screen. Use this screen to view in-depth information about the trusted remote host's certificate and/or change the certificate's name.

Figure 130 Trusted Remote Host Details



The following table describes the labels in this screen.

Table 93 Trusted Remote Host Details

LABEL	DESCRIPTION
Certificate Name	This field displays the identifying name of this certificate. If you want to change the name, type up to 31 characters to identify this key certificate. You may use any character (not including spaces).
Certification Path	Click the **Refresh** button to have this read-only text box display the end entity's own certificate and a list of certification authority certificates in the hierarchy of certification authorities that validate a certificate's issuing certification authority. For a trusted host, the list consists of the end entity's own certificate and the default self-signed certificate that the ZyXEL Device uses to sign remote host certificates.
Refresh	Click **Refresh** to display the certification path.
Certificate Information	These read-only fields display detailed information about the certificate.
Type	This field displays general information about the certificate. With trusted remote host certificates, this field always displays CA-signed. The ZyXEL Device is the Certification Authority that signed the certificate. X.509 means that this certificate was created and signed according to the ITU-T X.509 recommendation that defines the formats for public-key certificates.

Table 93 Trusted Remote Host Details (continued)

LABEL	DESCRIPTION
Version	This field displays the X.509 version number.
Serial Number	This field displays the certificate's identification number given by the device that created the certificate.
Subject	This field displays information that identifies the owner of the certificate, such as Common Name (CN), Organizational Unit (OU), Organization (O) and Country (C).
Issuer	This field displays identifying information about the default self-signed certificate on the ZyXEL Device that the ZyXEL Device uses to sign the trusted remote host certificates.
Signature Algorithm	This field displays the type of algorithm that the ZyXEL Device used to sign the certificate, which is rsa-pkcs1-sha1 (RSA public-private key encryption algorithm and the SHA1 hash algorithm).
Valid From	This field displays the date that the certificate becomes applicable. The text displays in red and includes a Not Yet Valid! message if the certificate has not yet become applicable.
Valid To	This field displays the date that the certificate expires. The text displays in red and includes an Expiring! or Expired! message if the certificate is about to expire or has already expired.
Key Algorithm	This field displays the type of algorithm that was used to generate the certificate's key pair (the ZyXEL Device uses RSA encryption) and the length of the key set in bits (1024 bits for example).
Subject Alternative Name	This field displays the certificate's owner's IP address (IP), domain name (DNS) or e-mail address (EMAIL).
Key Usage	This field displays for what functions the certificate's key can be used. For example, "DigitalSignature" means that the key can be used to sign certificates and "KeyEncipherment" means that the key can be used to encrypt text.
Basic Constraint	This field displays general information about the certificate. For example, Subject Type=CA means that this is a certification authority's certificate and "Path Length Constraint=1" means that there can only be one certification authority in the certificate's path.
MD5 Fingerprint	This is the certificate's message digest that the ZyXEL Device calculated using the MD5 algorithm. You cannot use this value to verify that this is the remote host's actual certificate because the ZyXEL Device has signed the certificate; thus causing this value to be different from that of the remote hosts actual certificate. See Section 15.12 on page 228 for how to verify a remote host's certificate.
SHA1 Fingerprint	This is the certificate's message digest that the ZyXEL Device calculated using the SHA1 algorithm. You cannot use this value to verify that this is the remote host's actual certificate because the ZyXEL Device has signed the certificate; thus causing this value to be different from that of the remote hosts actual certificate. See Section 15.12 on page 228 for how to verify a remote host's certificate.
Certificate in PEM (Base-64) Encoded Format	This read-only text box displays the certificate or certification request in Privacy Enhanced Mail (PEM) format. PEM uses 64 ASCII characters to convert the binary certificate into a printable form. You can copy and paste the certificate into an e-mail to send to friends or colleagues or you can copy and paste the certificate into a text editor and save the file on a management computer for later distribution (via floppy disk for example).
Back	Click **Back** to return to the previous screen.
Export	Click this button and then **Save** in the **File Download** screen. The **Save As** screen opens, browse to the location that you want to use and click **Save**.

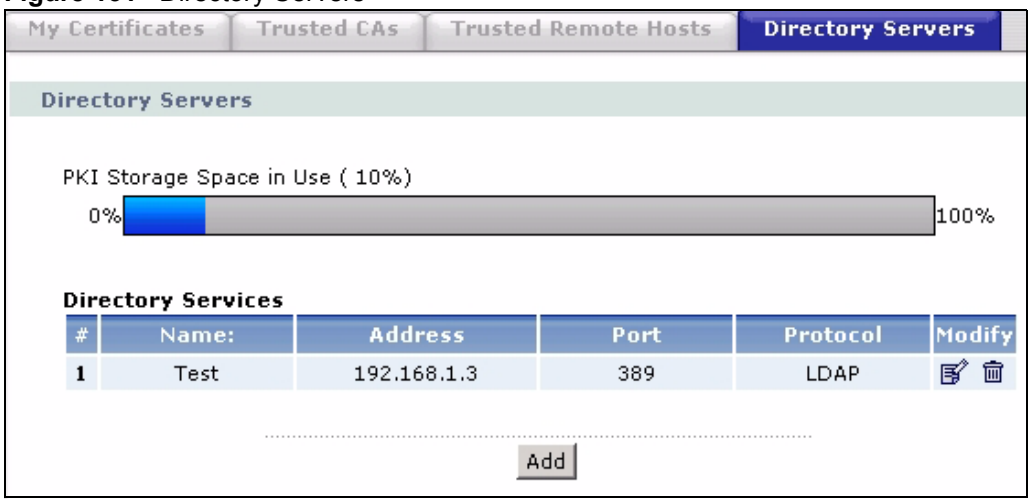
Table 93 Trusted Remote Host Details (continued)

LABEL	DESCRIPTION
Apply	Click **Apply** to save your changes back to the ZyXEL Device. You can only change the name of the certificate.
Cancel	Click **Cancel** to quit configuring this screen and return to the **Trusted Remote Hosts** screen.

15.15 Directory Servers

Click **Security** > **Certificates** > **Directory Servers** to open the **Directory Servers** screen. This screen displays a summary list of directory servers (that contain lists of valid and revoked certificates) that have been saved into the ZyXEL Device. If you decide to have the ZyXEL Device check incoming certificates against the issuing certification authority's list of revoked certificates, the ZyXEL Device first checks the server(s) listed in the **CRL Distribution Points** field of the incoming certificate. If the certificate does not list a server or the listed server is not available, the ZyXEL Device checks the servers listed here.

Figure 131 Directory Servers



The following table describes the labels in this screen.

Table 94 Directory Servers

LABEL	DESCRIPTION
PKI Storage Space in Use	This bar displays the percentage of the ZyXEL Device's PKI storage space that is currently in use. The bar turns from green to red when the maximum is being approached. When the bar is red, you should consider deleting expired or unnecessary certificates before adding more certificates.
#	The index number of the directory server. The servers are listed in alphabetical order.
Name	This field displays the name used to identify this directory server.
Address	This field displays the IP address or domain name of the directory server.
Port	This field displays the port number that the directory server uses.
Protocol	This field displays the protocol that the directory server uses.

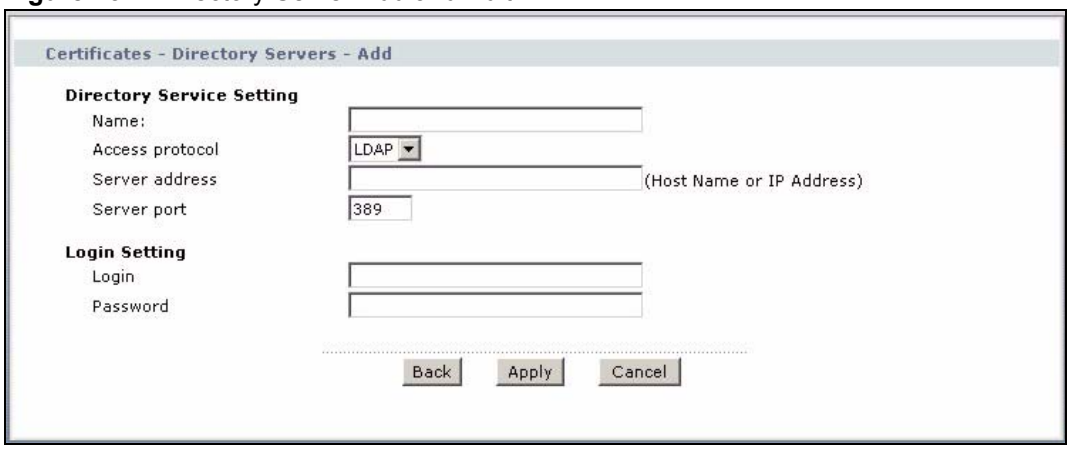
Table 94 Directory Servers

LABEL	DESCRIPTION
Modify	Click the Edit icon to open a screen where you can change the information about the directory server. Click the Remove icon to remove the directory server entry. A window displays asking you to confirm that you want to delete the directory server. Note that subsequent certificates move up by one when you take this action.
Add	Click **Add** to open a screen where you can configure information about a directory server so that the ZyXEL Device can access it.

15.16 Directory Server Add and Edit

Click **Security** > **Certificates** > **Directory Servers** to open the **Directory Servers** screen. Click **Add** (or the details icon) to open the **Directory Server Add** screen. Use this screen to configure information about a directory server that the ZyXEL Device can access.

Figure 132 Directory Server Add and Edit



The following table describes the labels in this screen.

Table 95 Directory Server Add and Edit

LABEL	DESCRIPTION
Directory Service Setting	
Name	Type up to 31 ASCII characters (spaces are not permitted) to identify this directory server.
Access Protocol	Use the drop-down list box to select the access protocol used by the directory server. **LDAP** (Lightweight Directory Access Protocol) is a protocol over TCP that specifies how clients access directories of certificates and lists of revoked certificates.[A]
Server Address	Type the IP address (in dotted decimal notation) or the domain name of the directory server.
Server Port	This field displays the default server port number of the protocol that you select in the **Access Protocol** field. You may change the server port number if needed, however you must use the same server port number that the directory server uses. 389 is the default server port number for LDAP.

Table 95 Directory Server Add and Edit

LABEL	DESCRIPTION
Login Setting	
Login	The ZyXEL Device may need to authenticate itself in order to assess the directory server. Type the login name (up to 31 ASCII characters) from the entity maintaining the directory server (usually a certification authority).
Password	Type the password (up to 31 ASCII characters) from the entity maintaining the directory server (usually a certification authority).
Back	Click **Back** to return to the **Directory Servers** screen.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to quit configuring this screen.

A. At the time of writing, LDAP is the only choice of directory server access protocol.

16

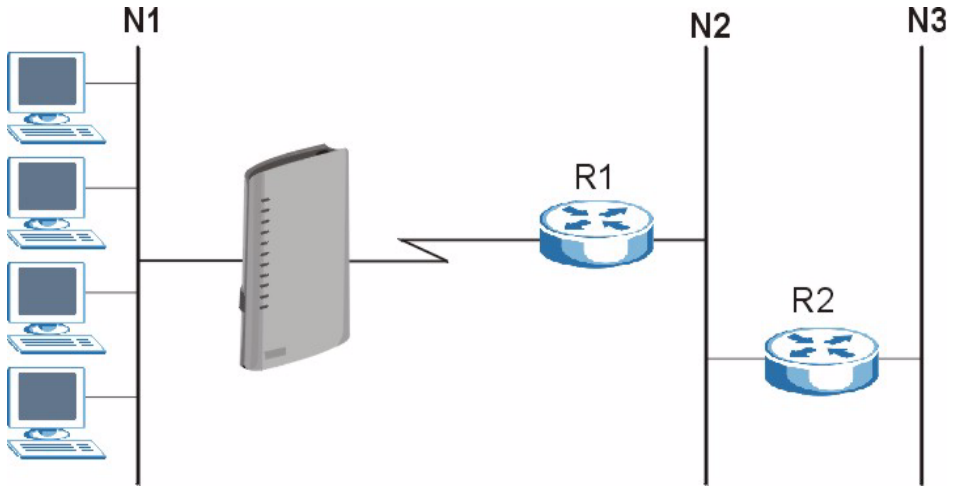
Static Route

This chapter shows you how to configure static routes for your ZyXEL Device.

16.1 Static Route

Each remote node specifies only the network to which the gateway is directly connected, and the ZyXEL Device has no knowledge of the networks beyond. For instance, the ZyXEL Device knows about network N2 in the following figure through remote node Router 1. However, the ZyXEL Device is unable to route a packet to network N3 because it doesn't know that there is a route through the same remote node Router 1 (via gateway Router 2). The static routes are for you to tell the ZyXEL Device about the networks beyond the remote nodes.

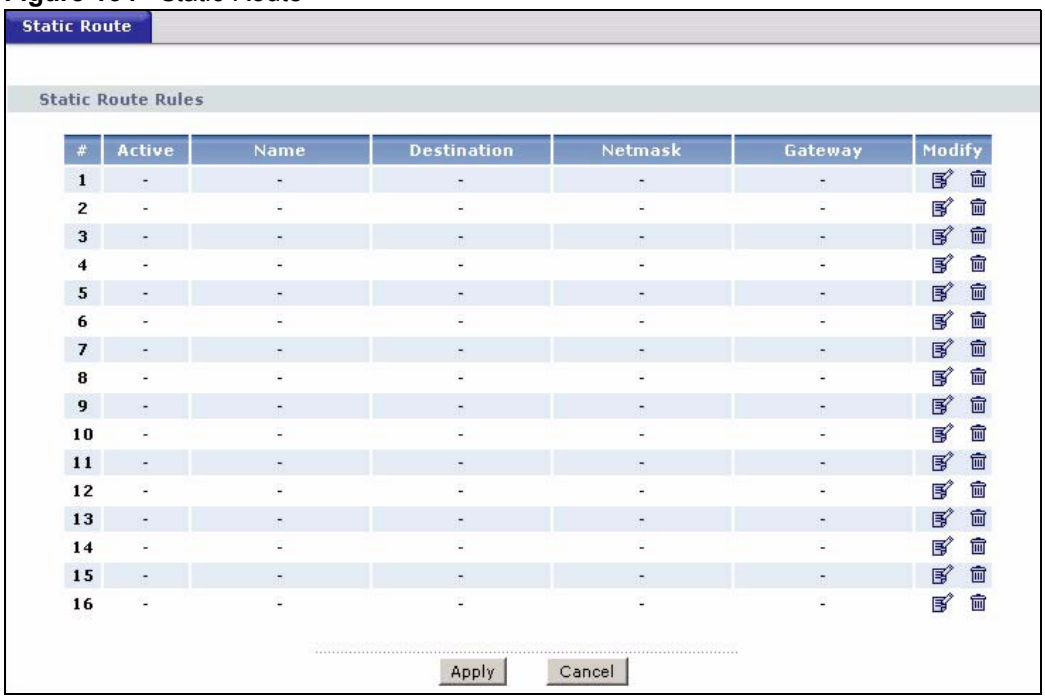
Figure 133 Example of Static Routing Topology



16.2 Configuring Static Route

Click **Advanced** > **Static Route** to open the **Static Route** screen.

Figure 134 Static Route


Static Route
Static Route Rules
Active Name Destination Netmask Gateway Modify
1 - - - - -
2 - - - - -
3 - - - - -
4 - - - - -
5 - - - - -
6 - - - - -
7 - - - - -
8 - - - - -
9 - - - - -
10 - - - - -
11 - - - - -
12 - - - - -
13 - - - - -
14 - - - - -
15 - - - - -
16 - - - - -
Apply
Cancel

The following table describes the labels in this screen.

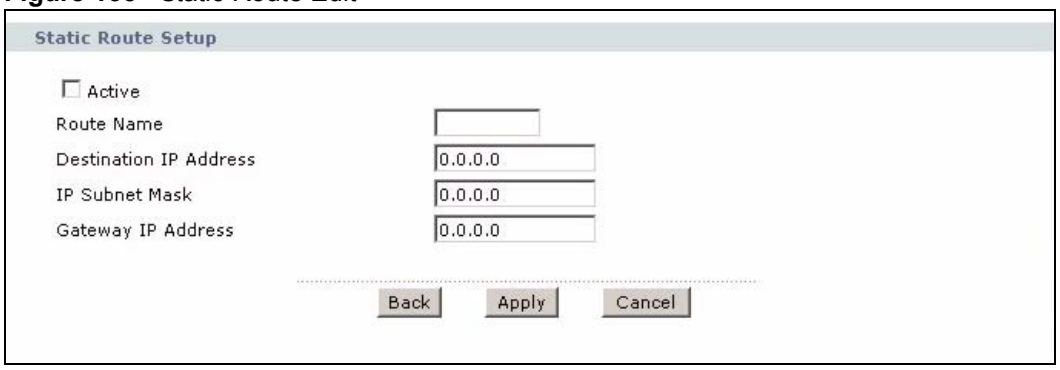
Table 96 Static Route

LABEL	DESCRIPTION
#	This is the number of an individual static route.
Active	This field indicates whether the rule is active or not. Clear the check box to disable the rule. Select the check box to enable it.
Name	This is the name that describes or identifies this route.
Destination	This parameter specifies the IP network address of the final destination. Routing is always based on network number.
Netmask	This parameter specifies the IP network subnet mask of the final destination.
Gateway	This is the IP address of the gateway. The gateway is a router or switch on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their destinations.
Modify	Click the Edit icon to go to the screen where you can set up a static route on the ZyXEL Device. Click the Remove icon to remove a static route from the ZyXEL Device. A window displays asking you to confirm that you want to delete the route.
Apply	Click this to apply your changes to the ZyXEL Device.
Cancel	Click this to return to the previously saved configuration.

16.2.1 Static Route Edit

Select a static route index number and click **Edit**. The screen shown next appears. Use this screen to configure the required information for a static route.

Figure 135 Static Route Edit



The following table describes the labels in this screen.

Table 97 Static Route Edit

LABEL	DESCRIPTION
Active	This field allows you to activate/deactivate this static route.
Route Name	Enter the name of the IP static route. Leave this field blank to delete this static route.
Destination IP Address	This parameter specifies the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
IP Subnet Mask	Enter the IP subnet mask here.
Gateway IP Address	Enter the IP address of the gateway. The gateway is a router or switch on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their destinations.
Back	Click **Back** to return to the previous screen without saving.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17

Quality of Service (QoS)

This chapter contains information about configuring QoS, editing classifiers and viewing the ZyXEL Device's QoS packet statistics.

17.1 QoS Overview

Quality of Service (QoS) refers to both a network's ability to deliver data with minimum delay, and the networking methods used to control the use of bandwidth. Without QoS, all traffic data is equally likely to be dropped when the network is congested. This can cause a reduction in network performance and make the network inadequate for time-critical application such as video-on-demand.

Configure QoS on the ZyXEL Device to group and prioritize application traffic and fine-tune network performance. Setting up QoS involves these steps:

1. Configure classifiers to sort traffic into different flows.
2. Assign priority and define actions to be performed for a classified traffic flow.

The ZyXEL Device assigns each packet a priority and then queues the packet accordingly. Packets assigned a high priority are processed more quickly than those with low priority if there is congestion, allowing time-sensitive applications to flow more smoothly. Time-sensitive applications include both those that require a low level of latency (delay) and a low level of jitter (variations in delay) such as Voice over IP (VoIP) or Internet gaming, and those for which jitter alone is a problem such as Internet radio or streaming video.

17.1.1 IEEE 802.1Q Tag

The IEEE 802.1Q standard defines an explicit VLAN tag in the MAC header to identify the VLAN membership of a frame across bridges. A VLAN tag includes the 12-bit VLAN ID and 3-bit user priority. The VLAN ID associates a frame with a specific VLAN and provides the information that devices need to process the frame across the network.

IEEE 802.1p specifies the user priority field and defines up to eight separate traffic types. The following table describes the traffic types defined in the IEEE 802.1d standard (which incorporates the 802.1p).

Table 98 IEEE 802.1p Priority Level and Traffic Type

PRIORITY LEVEL	TRAFFIC TYPE
Level 7	Typically used for network control traffic such as router configuration messages.
Level 6	Typically used for voice traffic that is especially sensitive to jitter (jitter is the variations in delay).

Table 98 IEEE 802.1p Priority Level and Traffic Type

PRIORITY LEVEL	TRAFFIC TYPE
Level 5	Typically used for video that consumes high bandwidth and is sensitive to jitter.
Level 4	Typically used for controlled load, latency-sensitive traffic such as SNA (Systems Network Architecture) transactions.
Level 3	Typically used for “excellent effort” or better than best effort and would include important business traffic that can tolerate some delay.
Level 2	This is for “spare bandwidth”.
Level 1	This is typically used for non-critical “background” traffic such as bulk transfers that are allowed but that should not affect other applications and users.
Level 0	Typically used for best-effort traffic.

17.1.2 IP Precedence

Similar to IEEE 802.1p prioritization at layer-2, you can use IP precedence to prioritize packets in a layer-3 network. IP precedence uses three bits of the eight-bit ToS (Type of Service) field in the IP header. There are eight classes of services (ranging from zero to seven) in IP precedence. Zero is the lowest priority level and seven is the highest.

17.1.3 DiffServ

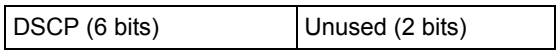
QoS is used to prioritize source-to-destination traffic flows. All packets in the flow are given the same priority. You can use CoS (class of service) to give different priorities to different packet types.

DiffServ (Differentiated Services) is a class of service (CoS) model that marks packets so that they receive specific per-hop treatment at DiffServ-compliant network devices along the route based on the application types and traffic flow. Packets are marked with DiffServ Code Points (DSCPs) indicating the level of service desired. This allows the intermediary DiffServ-compliant network devices to handle the packets differently depending on the code points without the need to negotiate paths or remember state information for every flow. In addition, applications do not have to request a particular service or give advanced notice of where the traffic is going.

17.1.3.1 DSCP and Per-Hop Behavior

DiffServ defines a new DS (Differentiated Services) field to replace the Type of Service (TOS) field in the IP header. The DS field contains a 2-bit unused field and a 6-bit DSCP field which can define up to 64 service levels. The following figure illustrates the DS field.

DSCP is backward compatible with the three precedence bits in the ToS octet so that non-DiffServ compliant, ToS-enabled network device will not conflict with the DSCP mapping.



The DSCP value determines the forwarding behavior, the PHB (Per-Hop Behavior), that each packet gets across the DiffServ network. Based on the marking rule, different kinds of traffic can be marked for different kinds of forwarding. Resources can then be allocated according to the DSCP values and the configured policies.

17.1.4 Automatical Priority Queue Assignment

If you enable QoS on the ZyXEL Device, the ZyXEL Device can automatically base on the IEEE 802.1p priority level, IP precedence and/or packet length to assign priority to traffic which does not match a class.

The following table shows you the internal layer-2 and layer-3 QoS mapping on the ZyXEL Device. On the ZyXEL Device, traffic assigned to higher priority queues gets through faster while traffic in lower index queues is dropped if the network is congested.

Table 99 Internal Layer2 and Layer3 QoS Mapping

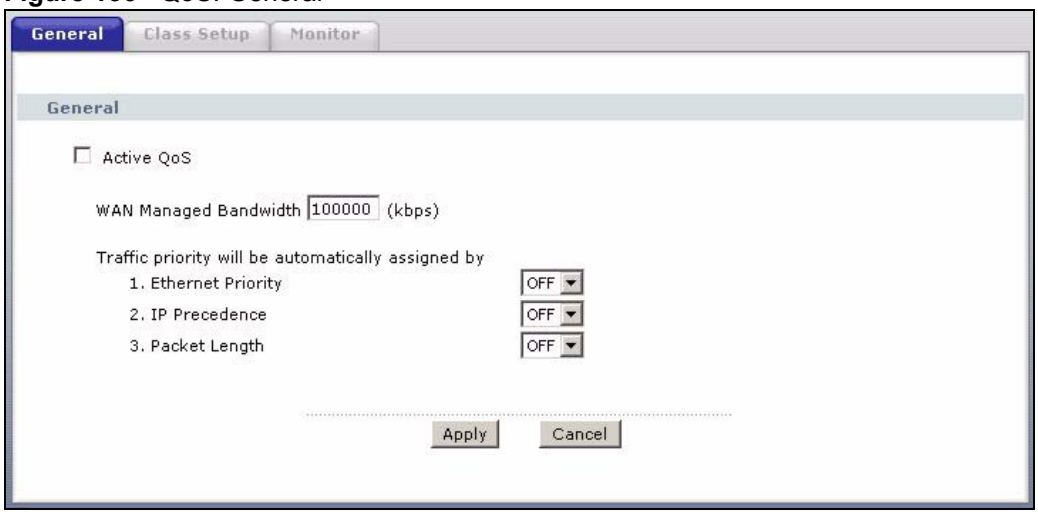
PRIORITY QUEUE	LAYER 2	LAYER 3		
	IEEE 802.1P USER PRIORITY (ETHERNET PRIORITY)	TOS (IP PRECEDENCE)	DSCP	IP PACKET LENGTH (BYTE)
0	1	0	000000	
1	2			
2	0	0	000000	>1100
3	3	1	001110 001100 001010 001000	250~1100
4	4	2	010110 010100 010010 010000	
5	5	3	011110 011100 011010 011000	<250
6	6	4	100110 100100 100010 100000	
		5	101110 101000	
7	7	6	110000 111000	
		7		

17.2 Configuring QoS General Screen

Click **Advanced > QoS** to open the screen as shown next.

Use this screen to enable or disable QoS, and select to have the ZyXEL Device automatically assign priority to traffic according to the IEEE 802.1p priority level, IP precedence and/or packet length. See Section 17.1 on page 239 for more information.

Figure 136 QoS: General



The following table describes the labels in this screen.

Table 100 QoS: General

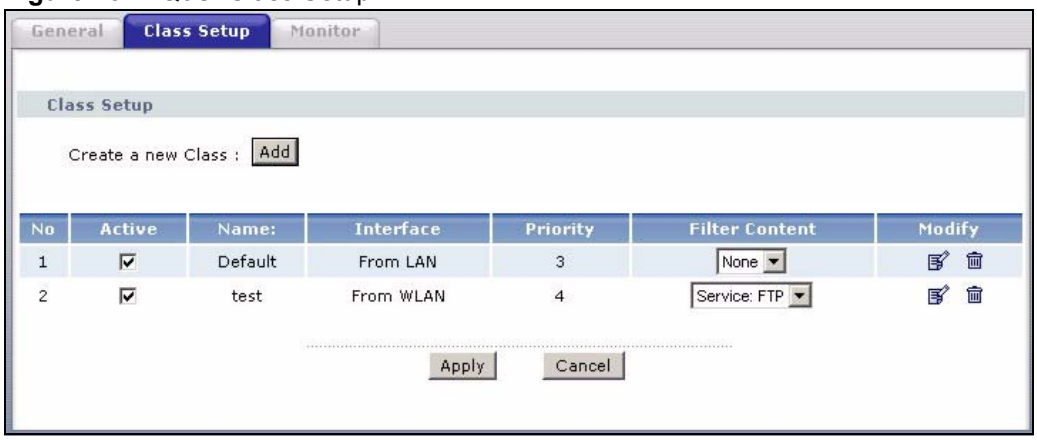
LABEL	DESCRIPTION
Active QoS	Select the check box to turn on QoS to improve your network performance. You can give priority to traffic that the ZyXEL Device forwards out through the WAN interface. Give high priority to voice and video to make them run more smoothly. Similarly, give low priority to many large file downloads so that they do not reduce the quality of other applications.
WAN Managed Bandwidth	Enter the amount of bandwidth for the WAN interface that you want to allocate using QoS. The recommendation is to set this speed to match the interface's actual transmission speed. For example, set the WAN interface speed to 100000 kbps if your Internet connection has an upstream transmission speed of 100 Mbps. You can set this number higher than the interface's actual transmission speed. This will stop lower priority traffic from being sent if higher priority traffic uses all of the actual bandwidth. You can also set this number lower than the interface's actual transmission speed. This will cause the ZyXEL Device to not use some of the interface's available bandwidth.
Traffic priority will be automatically assigned by	These fields are ignored if traffic matches a class you configured in the **Class Setup** screen. If you select **ON** and traffic does not match a class configured in the **Class Setup** screen, the ZyXEL Device assigns priority to unmatched traffic based on the IEEE 802.1p priority level, IP precedence and/or packet length. See Section 17.1.4 on page 241 for more information. If you select **OFF**, traffic which does not match a class is mapped to queue two.
Apply	Click **Apply** to save your settings back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.3 Class Setup

Use this screen to add, edit or delete classifiers. A classifier groups traffic into data flows according to specific criteria such as the source address, destination address, source port number, destination port number or incoming interface. For example, you can configure a classifier to select traffic from the same protocol port (such as Telnet) to form a flow.

Click **Advanced > QoS > Class Setup** to open the following screen.

Figure 137 QoS: Class Setup



The following table describes the labels in this screen.

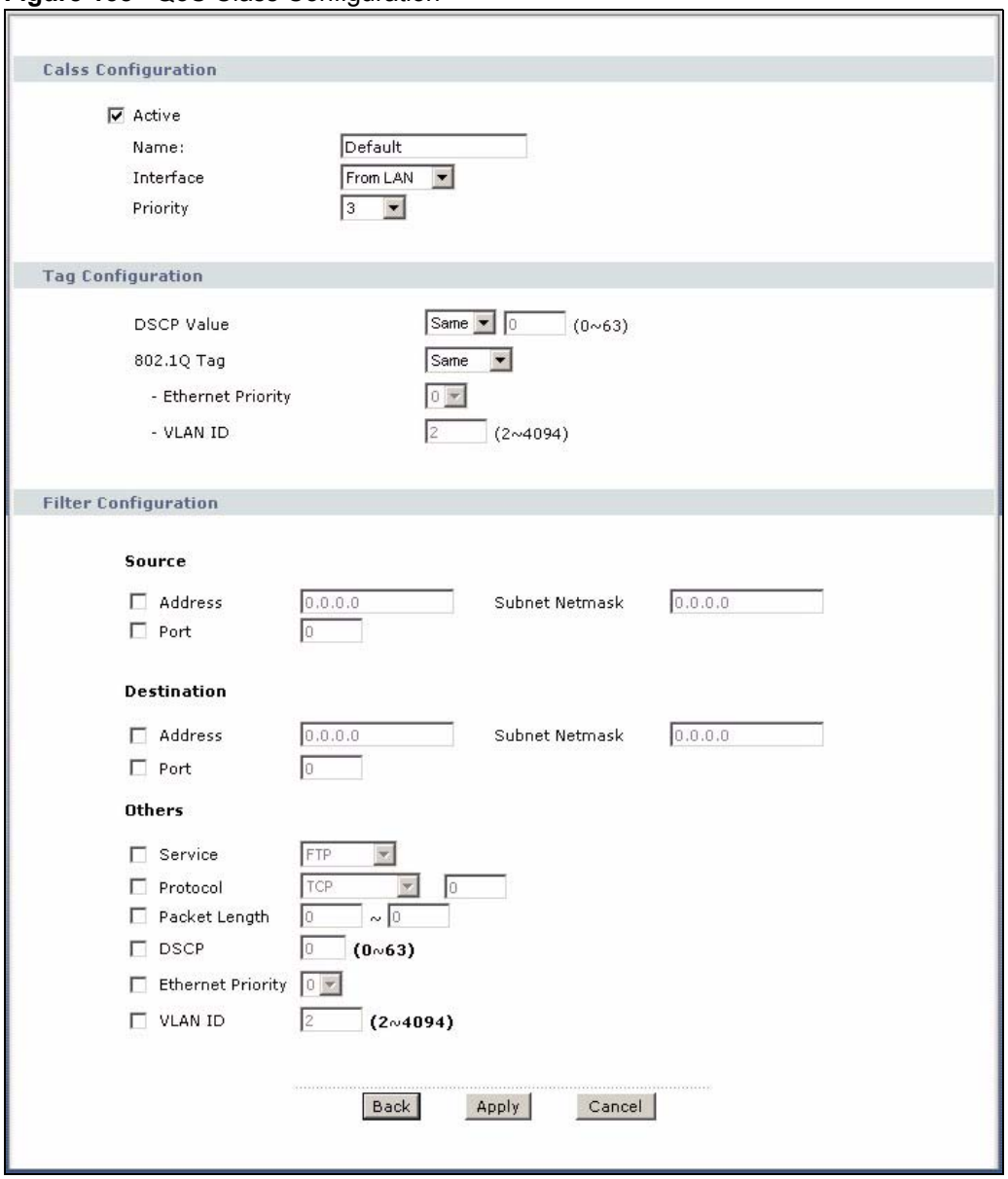
Table 101 Bandwidth Management: Rule Setup

LABEL	DESCRIPTION
Create a new Class	Click **Add** to create a new classifier.
No	This field displays the index number of the classifier.
Active	Select the check box to enable this classifier.
Name	This is the name of the classifier.
Interface	This shows the interface from which traffic of this classifier should come.
Priority	This is the priority assigned to traffic of this classifier.
Filter Content	This shows criteria specified in this classifier.
Modify	Click the Edit icon to go to the screen where you can edit the classifier. Click the Remove icon to delete an existing classifier.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.3.1 Class Configuration

Click the **Add** button or the **Edit** icon in the **Modify** field to configure a classifier.

Figure 138 QoS Class Configuration



See Appendix E on page 373 for a list of commonly-used services. The following table describes the labels in this screen.

Table 102 QoS Class Configuration

LABEL	DESCRIPTION
Class Configuration	
Active	Select the check box to enable this classifier.
Name	Enter a descriptive name of up to 20 printable English keyboard characters, including spaces.
Interface	Select from which interface traffic of this class should come.
Priority	Select a priority level (between 0 and 7) or select **Auto** to have the ZyXEL Device map the matched traffic to a queue according to the internal QoS mapping table. See Section 17.1.4 on page 241 for more information. "0" is the lowest priority level and "7" is the highest.

Table 102 QoS Class Configuration (continued)

LABEL	DESCRIPTION
Tag Configuration	
DSCP Value	Select **Same** to keep the DSCP fields in the packets. Select **Auto** to map the DSCP value to 802.1 priority level automatically. Select **Mark** to set the DSCP field with the value you configure in the field provided.
802.1Q Tag	Select **Same** to keep the priority setting and VLAN ID of the frames. Select **Auto** to map the 802.1 priority level to the DSCP value automatically. Select **Remove** to delete the priority queue tag and VLAN ID of the frames. Select **Mark** to replace the 802.1 priority field and VLAN ID with the value you set in the fields below. Select **Add** to treat all matched traffic untagged and add a second priority queue tag and VLAN.
Ethernet Priority	Select a priority level (between 0 and 7) from the drop down list box.
VLAN ID	Specify a VLAN ID number between 2 and 4094.
Filter Configuration	Use the following fields to configure the criteria for traffic classification.
Source	
Address	Select the check box and enter the source IP address in dotted decimal notation and the source subnet mask. A blank source IP address means any source IP address. Refer to the appendix for more information on IP subnetting.
Port	Select the check box and enter the port number of the source. 0 means any source port number. See *Appendix E on page 373* for some common services and port numbers.
Destination	
Address	Select the check box and enter the destination IP address in dotted decimal notation and the destination subnet mask. Refer to the appendix for more information on IP subnetting.
Port	Select the check box and enter the port number of the destination. 0 means any source port number. See *Appendix E on page 373* for some common services and port numbers.
Others	
Service	This field simplifies classifier configuration by allowing you to select a predefined application. When you select a predefined application, you do not configure the rest of the filter fields. SIP (Session Initiation Protocol) is a signaling protocol used in Internet telephony, instant messaging and other VoIP (Voice over IP) applications. Select the check box and select **VoIP(SIP)** from the drop-down list box to configure this classifier for traffic that uses SIP. File Transfer Protocol (FTP) is an Internet file transfer service that operates on the Internet and over TCP/IP networks. A system running the FTP server accepts commands from a system running an FTP client. The service allows users to send commands to the server for uploading and downloading files. Select the check box and select **FTP** from the drop-down list box to configure this classifier for FTP traffic.
Protocol	Select this option and select the protocol (**TCP** or **UDP**) or select **User defined** and enter the protocol (service type) number. 0 means any protocol number.
Packet Length	Select this option and enter the minimum and maximum packet length (from 28 to 1500) in the fields provided.
DSCP	Select this option and specify a DSCP (DiffServ Code Point) number between 0 and 63 in the field provided.

Table 102 QoS Class Configuration (continued)

LABEL	DESCRIPTION
Ethernet Priority	Select this option and select a priority level (between 0 and 7) from the drop down list box. "0" is the lowest priority level and "7" is the highest.
VLAN ID	Select this option and specify a VLAN ID number between 2 and 4094.
Back	Click **Back** to go to the previous screen.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

17.3.2 QoS Example

In the following figure, your Internet connection has an upstream transmission speed of 50 Mbps. You configure a classifier to assign the highest priority queue (6) to VoIP traffic from the LAN interface, so that voice traffic would not get delayed when there is network congestion. Traffic from the boss's IP address (192.168.1.23 for example) is mapped to queue 5. Taffic that does not match these two classes are assigned priority queue based on the internal QoS mapping table on the ZyXEL Device.

Figure 139 QoS Example

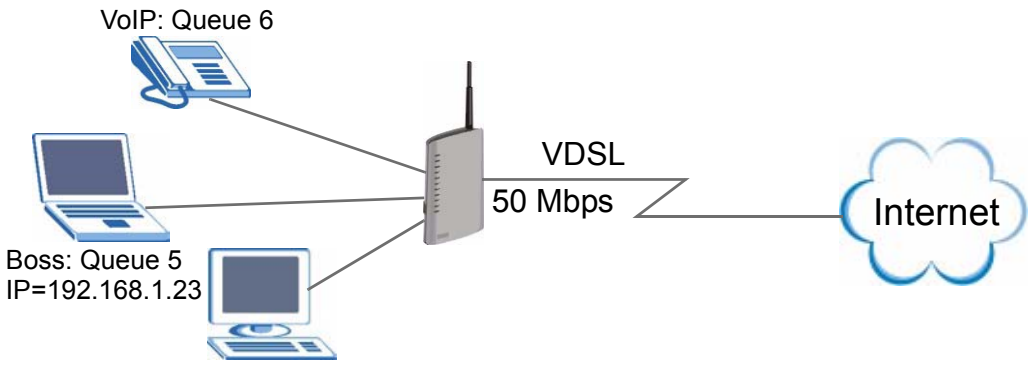


Figure 140 QoS Class Example: VoIP -1

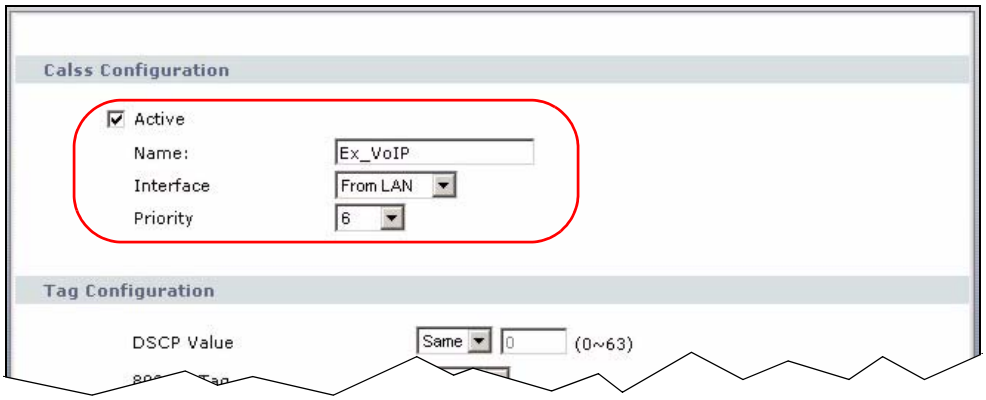


Figure 141 QoS Class Example: VoIP -2

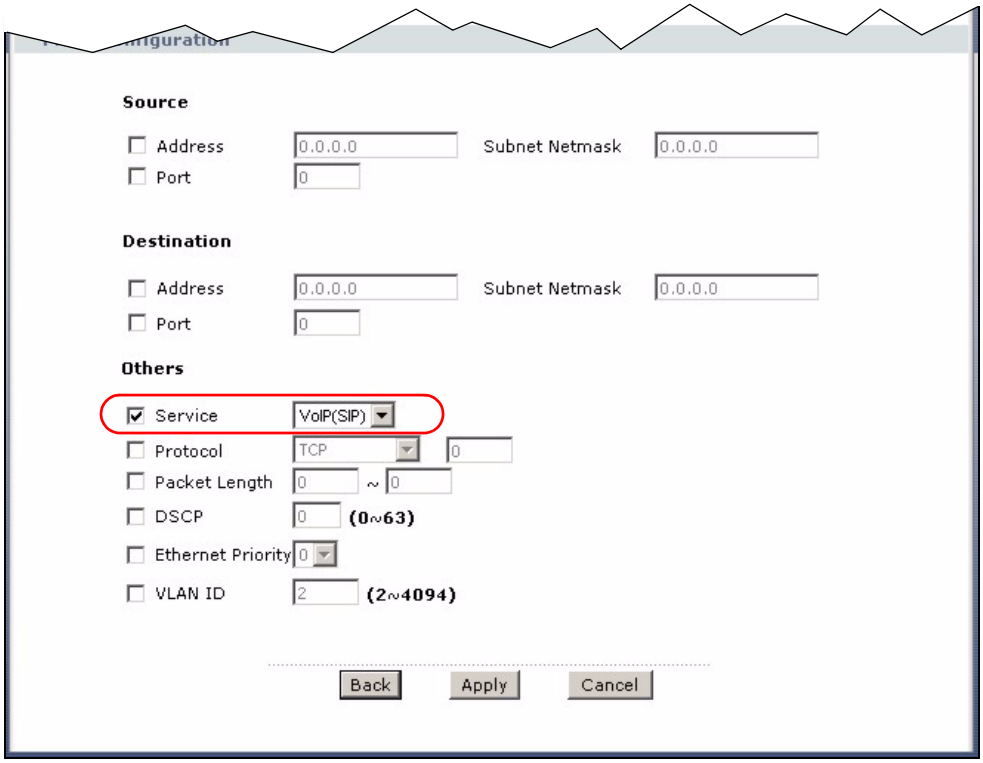


Figure 142 QoS Class Example: Boss -1

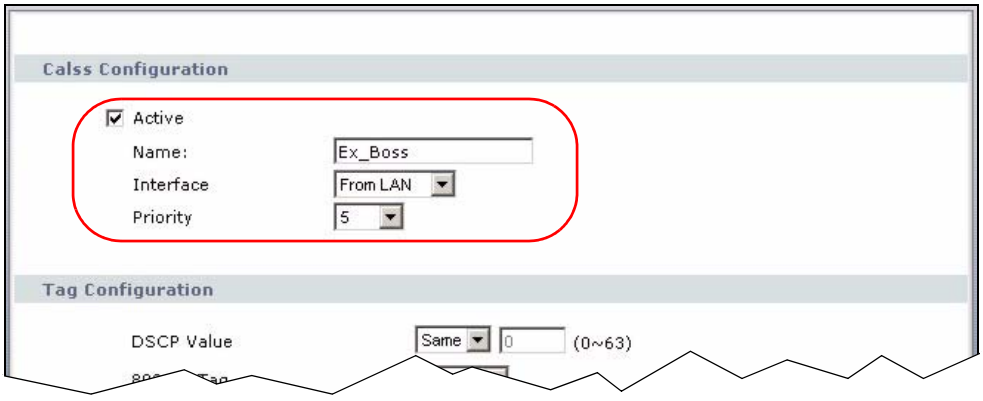
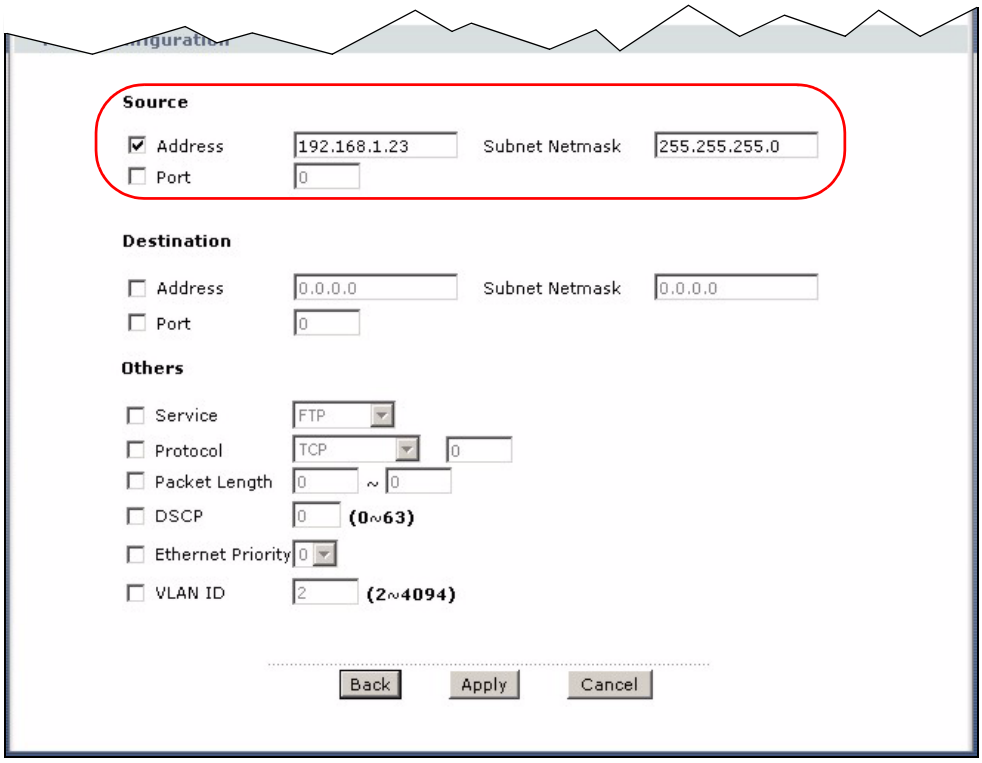


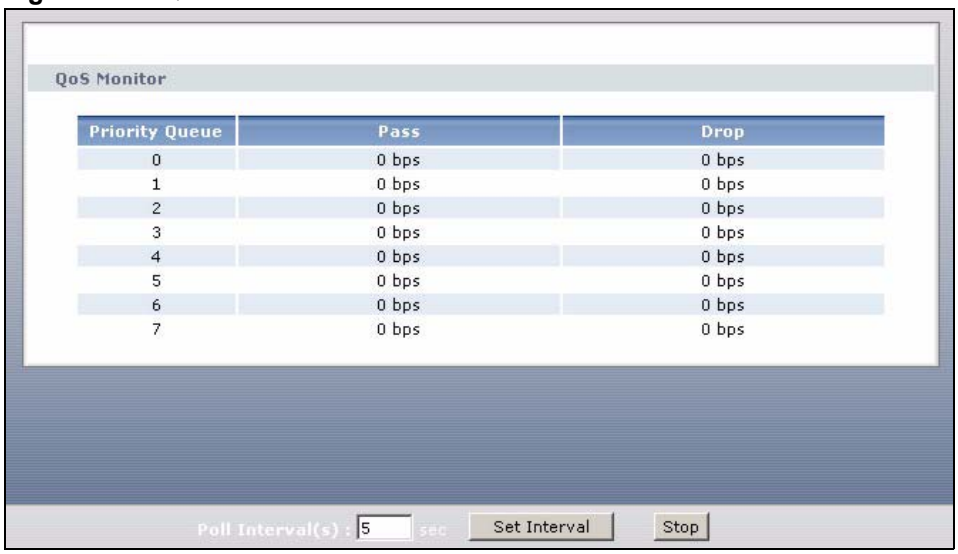
Figure 143 QoS Class Example: Boss -2



17.4 QoS Monitor

To view the ZyXEL Device's QoS packet statistics, click **Advanced > QoS > Monitor**. The screen appears as shown.

Figure 144 QoS Monitor



The following table describes the labels in this screen.

Table 103 QoS Monitor

LABEL	DESCRIPTION
Priority Queue	This shows the priority queue number. Traffic assigned to higher index queues gets through faster while traffic in lower index queues is dropped if the network is congested.
Pass	This shows how many packets mapped to this priority queue are transmitted successfully.
Drop	This shows how many packets mapped to this priority queue are dropped.
Poll Interval(s)	Enter the time interval for refreshing statistics in this field.
Set Interval	Click this button to apply the new poll interval you entered in the **Poll Interval(s)** field.
Stop	Click **Stop** to stop refreshing statistics.

18

Dynamic DNS Setup

This chapter discusses how to configure your ZyXEL Device to use Dynamic DNS.

18.1 Dynamic DNS Overview

Dynamic DNS allows you to update your current dynamic IP address with one or many dynamic DNS services so that anyone can contact you (in NetMeeting, CU-SeeMe, etc.). You can also access your FTP server or Web site on your own computer using a domain name (for instance myhost.dhs.org, where myhost is a name of your choice) that will never change instead of using an IP address that changes each time you reconnect. Your friends or relatives will always be able to call you even if they don't know your IP address.

First of all, you need to have registered a dynamic DNS account with www.dyndns.org. This is for people with a dynamic IP from their ISP or DHCP server that would still like to have a domain name. The Dynamic DNS service provider will give you a password or key.

18.1.1 DYNDNS Wildcard

Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

If you have a private WAN IP address, then you cannot use Dynamic DNS.

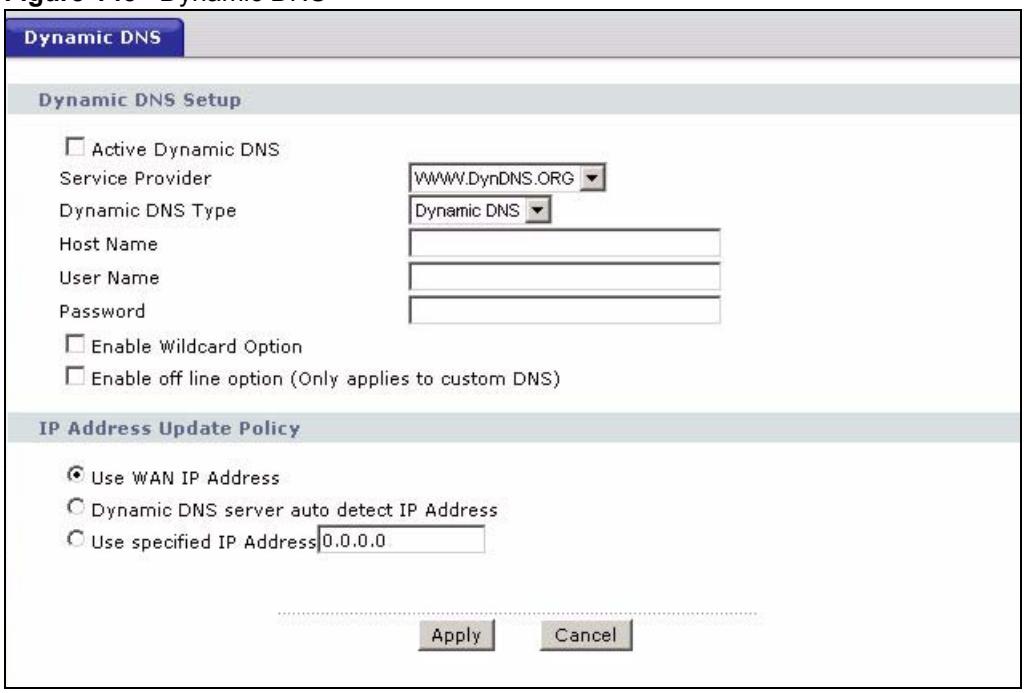
See Section 18.2 on page 251 for configuration instruction.

18.2 Configuring Dynamic DNS

To change your ZyXEL Device's DDNS, click **Advanced > Dynamic DNS**. The screen appears as shown.

See Section 18.1 on page 251 for more information.

Figure 145 Dynamic DNS



The following table describes the fields in this screen.

Table 104 Dynamic DNS

LABEL	DESCRIPTION
Dynamic DNS Setup	
Active Dynamic DNS	Select this check box to use dynamic DNS.
Service Provider	This is the name of your Dynamic DNS service provider.
Dynamic DNS Type	Select the type of service that you are registered for from your Dynamic DNS service provider.
Host Name	Type the domain name assigned to your ZyXEL Device by your Dynamic DNS provider. You can specify up to two host names in the field separated by a comma (",").
User Name	Type your user name.
Password	Type the password assigned to you.
Enable Wildcard Option	Select the check box to enable DynDNS Wildcard.
Enable off line option	This option is available when **CustomDNS** is selected in the **DDNS Type** field. Check with your Dynamic DNS service provider to have traffic redirected to a URL (that you can specify) while you are off line.
IP Address Update Policy	
Use WAN IP Address	Select this option to update the IP address of the host name(s) to the WAN IP address.

Table 104 Dynamic DNS (continued)

LABEL	DESCRIPTION
Dynamic DNS server auto detect IP Address	Select this option only when there are one or more NAT routers between the ZyXEL Device and the DDNS server. This feature has the DDNS server automatically detect and use the IP address of the NAT router that has a public IP address. Note: The DDNS server may not be able to detect the proper IP address if there is an HTTP proxy server between the ZyXEL Device and the DDNS server.
Use specified IP Address	Type the IP address of the host name(s). Use this if you have a static IP address.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

19

Remote Management Configuration

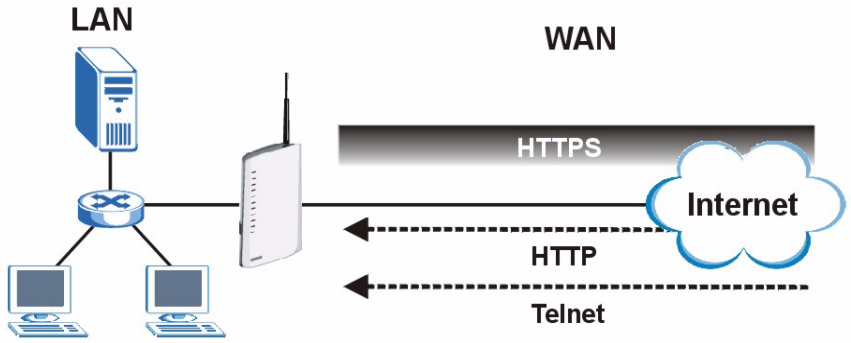
This chapter provides information on configuring remote management.

19.1 Remote Management Overview

Remote management allows you to determine which services/protocols can access which ZyXEL Device interface (if any) from which computers.

The following figure shows secure and insecure management of the ZyXEL Device coming in from the WAN. HTTPS access is secure. HTTP and Telnet access are not secure.

Figure 146 Secure and Insecure Remote Management From the WAN



When you configure remote management to allow management from the WAN, you still need to configure a firewall rule to allow access.

You may manage your ZyXEL Device from a remote location via:

- Internet (WAN only)
- ALL (LAN and WAN)
- LAN only,
- Neither (Disable).

When you choose **WAN** only or **LAN & WAN**, you still need to configure a firewall rule to allow access.

To disable remote management of a service, select **Disable** in the corresponding **Access Status** field.

You may only have one remote management session running at a time. The ZyXEL Device automatically disconnects a remote management session of lower priority when another remote management session of higher priority starts. The priorities for the different types of remote management sessions are as follows.

1. Telnet
2. HTTP

19.1.1 Remote Management Limitations

Remote management does not work when:

- You have not enabled that service on the interface in the corresponding remote management screen.
- You have disabled that service in one of the remote management screens.
- The IP address in the **Secured Client IP** field does not match the client IP address. If it does not match, the ZyXEL Device will disconnect the session immediately.
- There is already another remote management session with an equal or higher priority running. You may only have one remote management session running at one time.
- There is a firewall rule that blocks it.

19.1.2 Remote Management and NAT

When NAT is enabled:

- Use the ZyXEL Device's WAN IP address when configuring from the WAN.
- Use the ZyXEL Device's LAN IP address when configuring from the LAN.

19.1.3 System Timeout

There is a default system management idle timeout of five minutes (three hundred seconds). The ZyXEL Device automatically logs you out if the management session remains idle for longer than this timeout period. The management session does not time out when a statistics screen is polling.

19.2 WWW (HTTP and HTTPS)

HTTPS (HyperText Transfer Protocol over Secure Socket Layer, or HTTP over SSL) is a web protocol that encrypts and decrypts web pages. Secure Socket Layer (SSL) is an application-level protocol that enables secure transactions of data by ensuring confidentiality (an unauthorized party cannot read the transferred data), authentication (one party can identify the other party) and data integrity (you know if data has been changed).

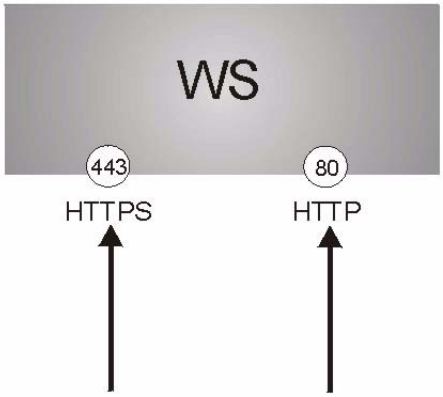
It relies upon certificates, public keys, and private keys (see Chapter 15 on page 211 for more information).

HTTPS on the ZyXEL Device is used so that you may securely access the ZyXEL Device using the web configurator. The SSL protocol specifies that the SSL server (the ZyXEL Device) must always authenticate itself to the SSL client (the computer which requests the HTTPS connection with the ZyXEL Device), whereas the SSL client only should authenticate itself when the SSL server requires it to do so (select **Authenticate Client Certificates** in the **REMOTE MGMT > WWW** screen). **Authenticate Client Certificates** is optional and if selected means the SSL-client must send the ZyXEL Device a certificate. You must apply for a certificate for the browser from a CA that is a trusted CA on the ZyXEL Device.

Please refer to the following figure.

1. HTTPS connection requests from an SSL-aware web browser go to port 443 (by default) on the ZyXEL Device's WS (web server).
2. HTTP connection requests from a web browser go to port 80 (by default) on the ZyXEL Device's WS (web server).

Figure 147 HTTPS Implementation

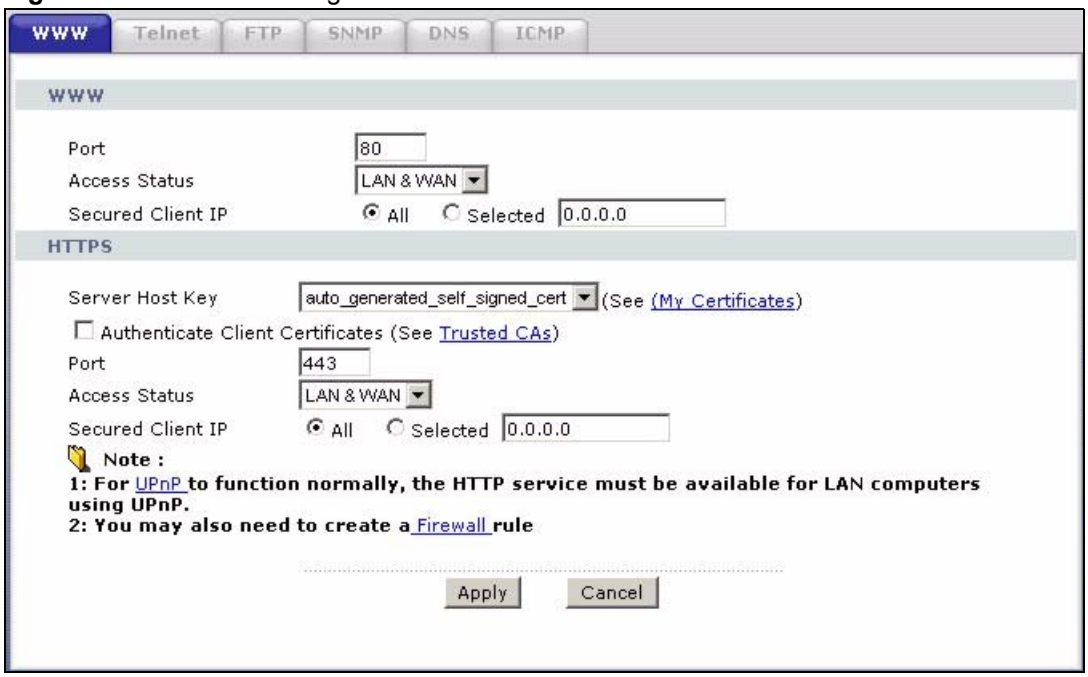


If you disable the **HTTP** service in the **REMOTE MGMT > WWW** screen, then the ZyXEL Device blocks all HTTP connection attempts.

19.3 WWW

Use this screen to configure the ZyXEL Device's HTTP and HTTPS management settings. Click **Advanced > Remote MGMT** to display the **WWW** screen.

Figure 148 Remote Management: WWW



The following table describes the labels in this screen.

Table 105 Remote Management: WWW

LABEL	DESCRIPTION
WWW	
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the ZyXEL Device using this service.
Secured Client IP	A secured client is a "trusted" computer that is allowed to communicate with the ZyXEL Device using this service. Select **All** to allow any computer to access the ZyXEL Device using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the ZyXEL Device using this service.
HTTPS	
Server Host Key	Select the **Server Host Key** that the ZyXEL Device will use to identify itself. The ZyXEL Device is the SSL server and must always authenticate itself to the SSL client (the computer which requests the HTTPS connection with the ZyXEL Device).
Authenticate Client Certificates	Select **Authenticate Client Certificates** (optional) to require the SSL client to authenticate itself to the ZyXEL Device by sending the ZyXEL Device a certificate. To do that the SSL client must have a CA-signed certificate from a CA that has been imported as a trusted CA on the ZyXEL Device (see Appendix K on page 791 on importing certificates for details).

Table 105 Remote Management: WWW

LABEL	DESCRIPTION
Port	The HTTPS proxy server listens on port 443 by default. If you change the HTTPS proxy server port to a different number on the ZyXEL Device, for example 8443, then you must notify people who need to access the ZyXEL Device web configurator to use "https://ZyXEL Device IP Address:**8443**" as the URL.
Access Status	Select the interface(s) through which a computer may access the ZyXEL Device using this service. You can allow only secure web configurator access by clearing all of the interface check boxes in the **HTTP Access Status** field and setting the **HTTPS Access Status** field to an interface(s).
Secured Client IP	A secure client is a "trusted" computer that is allowed to communicate with the ZyXEL Device using this service. Select **All** to allow any computer to access the ZyXEL Device using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the ZyXEL Device using this service.
Apply	Click **Apply** to save your settings back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

19.4 HTTPS Example

If you haven't changed the default HTTPS port on the ZyXEL Device, then in your browser enter "https://ZyXEL Device IP Address/" as the web site address where "ZyXEL Device IP Address" is the IP address or domain name of the ZyXEL Device you wish to access.

19.4.1 Internet Explorer Warning Messages

When you attempt to access the ZyXEL Device HTTPS server, a Windows dialog box pops up asking if you trust the server certificate. Click **View Certificate** if you want to verify that the certificate is from the ZyXEL Device.

You see the following **Security Alert** screen in Internet Explorer. Select **Yes** to proceed to the web configurator login screen; if you select **No**, then web configurator access is blocked.

Figure 149 Security Alert Dialog Box (Internet Explorer)

Security Alert
Information you exchange with this site cannot be viewed or changed by others. However, there is a problem with the site's security certificate.
The security certificate was issued by a company you have not chosen to trust. View the certificate to determine whether you want to trust the certifying authority.
The security certificate date is valid.
The name on the security certificate is invalid or does not match the name of the site
Do you want to proceed?
Yes
No
View Certificate

19.4.2 Netscape Navigator Warning Messages

When you attempt to access the ZyXEL Device HTTPS server, a **Website Certified by an Unknown Authority** screen pops up asking if you trust the server certificate. Click **Examine Certificate** if you want to verify that the certificate is from the ZyXEL Device.

If **Accept this certificate temporarily for this session** is selected, then click **OK** to continue in Netscape.

Select **Accept this certificate permanently** to import the ZyXEL Device's certificate into the SSL client.

Figure 150 Security Certificate 1 (Netscape)

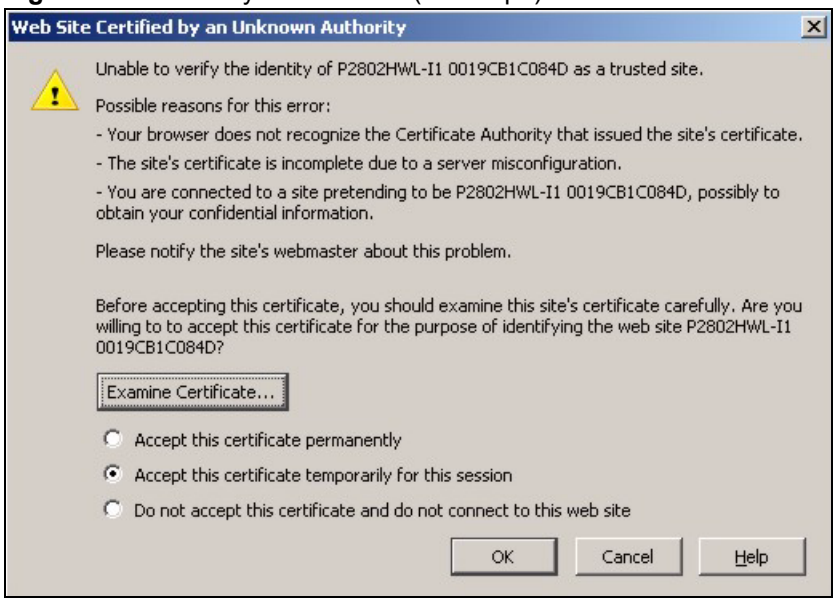

Web Site Certified by an Unknown Authority
Unable to verify the identity of P2802HWL-I1 0019CB1C084D as a trusted site.
Possible reasons for this error:
- Your browser does not recognize the Certificate Authority that issued the site's certificate.
- The site's certificate is incomplete due to a server misconfiguration.
- You are connected to a site pretending to be P2802HWL-I1 0019CB1C084D, possibly to obtain your confidential information.
Please notify the site's webmaster about this problem.
Before accepting this certificate, you should examine this site's certificate carefully. Are you willing to to accept this certificate for the purpose of identifying the web site P2802HWL-I1 0019CB1C084D?
Examine Certificate...
Accept this certificate permanently
Accept this certificate temporarily for this session
Do not accept this certificate and do not connect to this web site
OK
Cancel
Help

Figure 151 Security Certificate 2 (Netscape)

Security Error: Domain Name Mismatch
You have attempted to establish a connection with "192.168.1.1". However, the security certificate presented belongs to "P2802HWL-I1 0019CB1C084D". It is possible, though unlikely, that someone may be trying to intercept your communication with this web site.
If you suspect the certificate shown does not belong to "192.168.1.1", please cancel the connection and notify the site administrator.
View Certificate
OK
Cancel
Help

19.4.3 Avoiding the Browser Warning Messages

The following describes the main reasons that your browser displays warnings about the ZyXEL Device's HTTPS server certificate and what you can do to avoid seeing the warnings.

- The issuing certificate authority of the ZyXEL Device's HTTPS server certificate is not one of the browser's trusted certificate authorities. The issuing certificate authority of the ZyXEL Device's factory default certificate is the ZyXEL Device itself since the certificate is a self-signed certificate.
  - For the browser to trust a self-signed certificate, import the self-signed certificate into your operating system as a trusted certificate.
  - To have the browser trust the certificates issued by a certificate authority, import the certificate authority's certificate into your operating system as a trusted certificate. Refer to Appendix K on page 791 for details.
- The actual IP address of the HTTPS server (the IP address of the ZyXEL Device's port that you are trying to access) does not match the common name specified in the ZyXEL Device's HTTPS server certificate that your browser received. Do the following to check the common name specified in the certificate that your ZyXEL Device sends to HTTPS clients.

2a Click **Remote MGMT**. Write down the name of the certificate displayed in the **Server Host Key** field.

2b Click **Certificates**. Find the certificate and check its **Subject** column. **CN** stands for certificate's common name (see Figure 154 on page 263 for an example).

Use this procedure to have the ZyXEL Device use a certificate with a common name that matches the ZyXEL Device's actual IP address. You cannot use this procedure if you need to access the WAN port and it uses a dynamically assigned IP address.

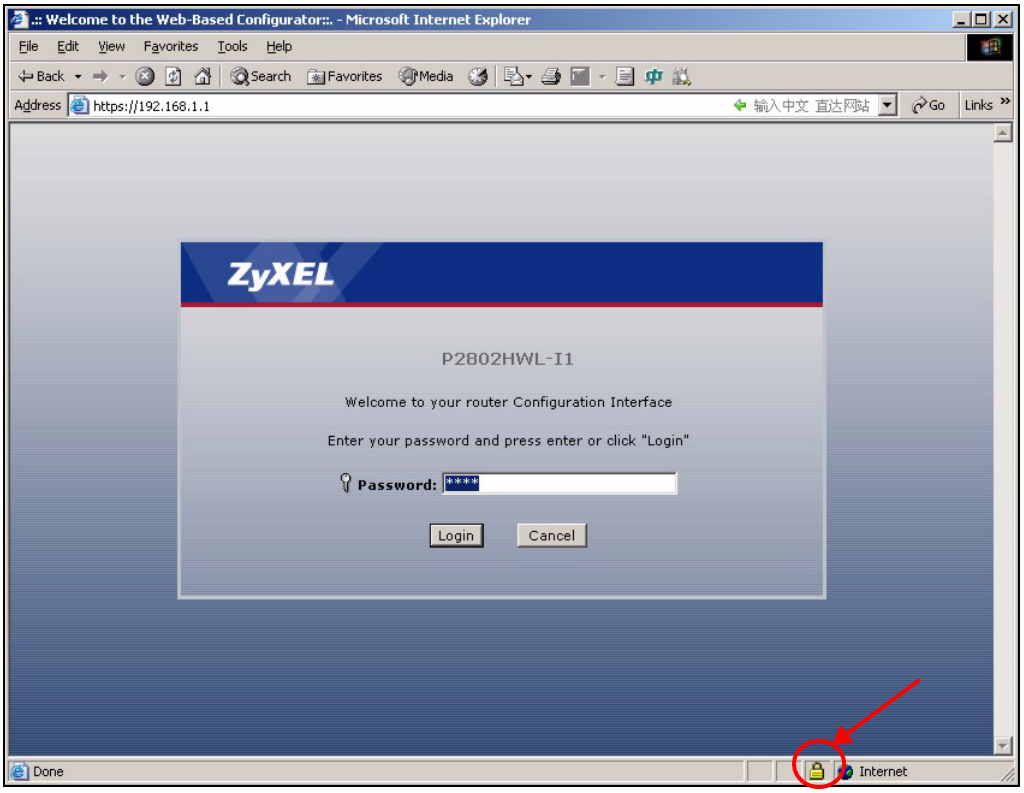
2a Create a new certificate for the ZyXEL Device that uses the IP address (of the ZyXEL Device's port that you are trying to access) as the certificate's common name. For example, to use HTTPS to access a LAN port with IP address 192.168.1.1, create a certificate that uses 192.168.1.1 as the common name.

2b Go to the remote management **WWW** screen and select the newly created certificate in the **Server Host Key** field. Click **Apply**.

19.4.4 Login Screen

After you accept the certificate, the ZyXEL Device login screen appears. The lock displayed in the bottom right of the browser status bar denotes a secure connection.

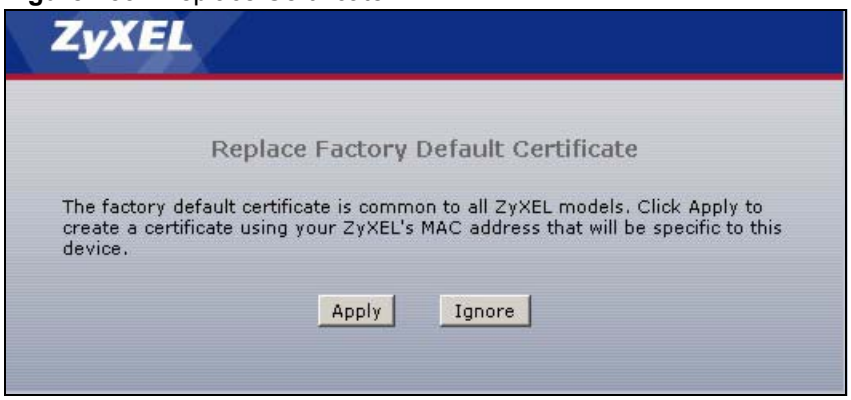
Figure 152 Example: Lock Denoting a Secure Connection



Click **Login** and you then see the next screen.

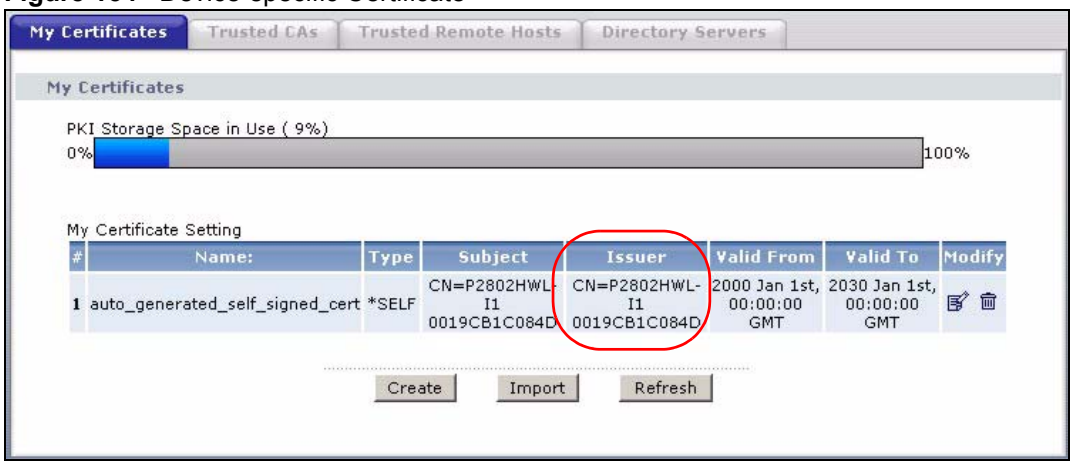
The factory default certificate is a common default certificate for all ZyXEL Device models.

Figure 153 Replace Certificate


ZyXEL
Replace Factory Default Certificate
The factory default certificate is common to all ZyXEL models. Click Apply to create a certificate using your ZyXEL's MAC address that will be specific to this device.
Apply
Ignore

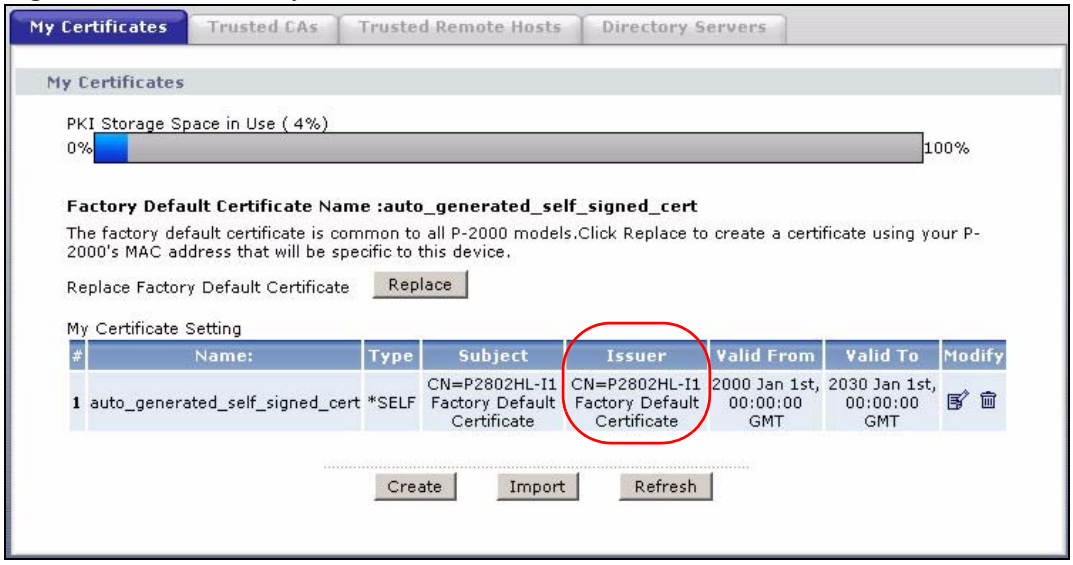
Click **Apply** in the **Replace Certificate** screen to create a certificate using your ZyXEL Device's MAC address that will be specific to this device. Click **Certificates** to open the **My Certificates** screen. You will see information similar to that shown in the following figure.

Figure 154 Device-specific Certificate



Click **Ignore** in the **Replace Certificate** screen to use the common ZyXEL Device certificate. You will then see this information in the **My Certificates** screen.

Figure 155 Common ZyXEL Device Certificate


My Certificates
Trusted CAs
Trusted Remote Hosts
Directory Servers
My Certificates
PKI Storage Space in Use (4%)
0%
100%
Factory Default Certificate Name :auto_generated_self_signed_cert
The factory default certificate is common to all P-2000 models.Click Replace to create a certificate using your P-2000's MAC address that will be specific to this device.
Replace Factory Default Certificate
Replace
My Certificate Setting
Name: Type Subject Issuer Valid From Valid To Modify
1 auto_generated_self_signed_cert *SELF CN=P2802HL-I1 Factory Default Certificate CN=P2802HL-I1 Factory Default Certificate 2000 Jan 1st, 00:00:00 GMT 2030 Jan 1st, 00:00:00 GMT
Create
Import
Refresh

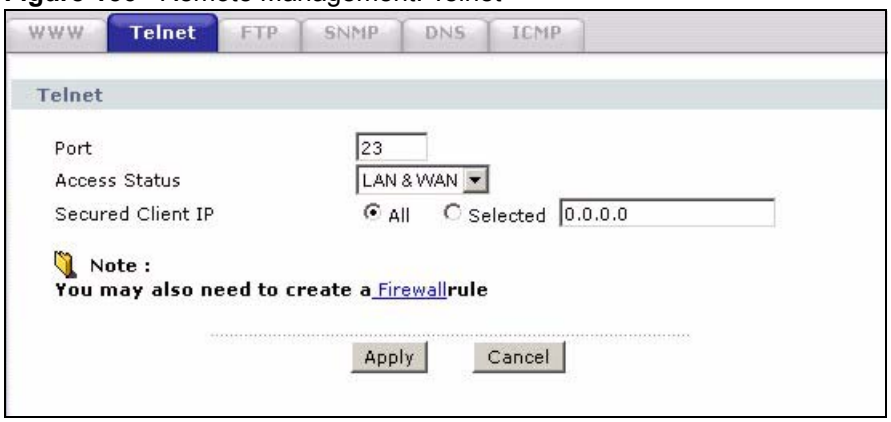
19.5 Telnet

You can use Telnet to access the ZyXEL Device. Specify which interfaces allow Telnet access and from which IP address the access can come.

19.6 Configuring Telnet

Click **Advanced > Remote MGMT** > **Telnet** tab to display the screen as shown. Use this screen to specify which interfaces allow Telnet access and from which IP address the access can come.

Figure 156 Remote Management: Telnet



The following table describes the labels in this screen.

Table 106 Remote Management: Telnet

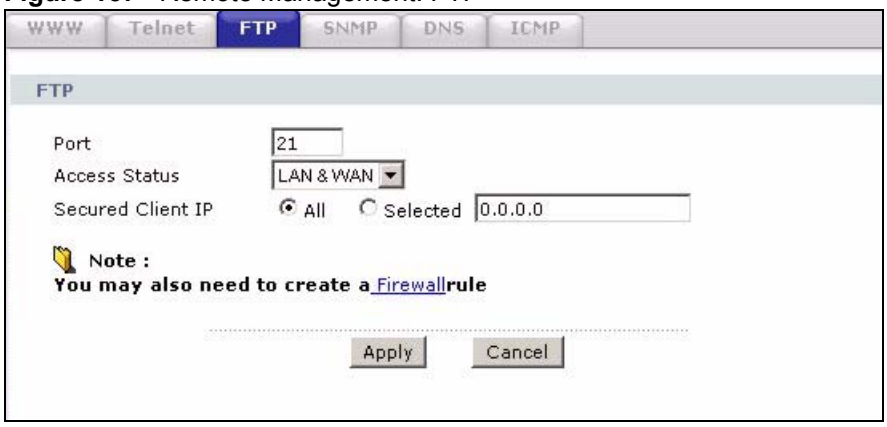
LABEL	DESCRIPTION
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the ZyXEL Device using this service.
Secured Client IP	A secured client is a “trusted” computer that is allowed to communicate with the ZyXEL Device using this service. Select **All** to allow any computer to access the ZyXEL Device using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the ZyXEL Device using this service.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

19.7 Configuring FTP

You can use FTP (File Transfer Protocol) to upload and download the ZyXEL Device’s firmware and configuration files, please see the User’s Guide chapter on firmware and configuration file maintenance for details. To use this feature, your computer must have an FTP client.

To change your ZyXEL Device’s FTP settings, click **Advanced > Remote MGMT** > **FTP**. The screen appears as shown. Use this screen to specify which interfaces allow FTP access and from which IP address the access can come.

Figure 157 Remote Management: FTP



The following table describes the labels in this screen.

Table 107 Remote Management: FTP

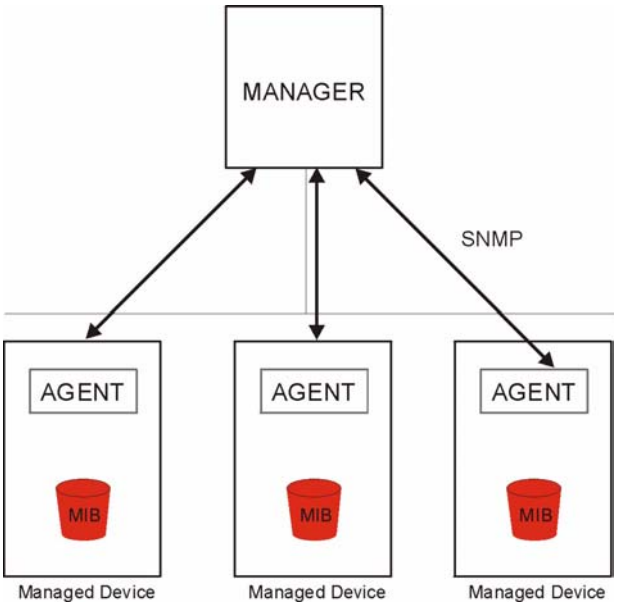
LABEL	DESCRIPTION
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the ZyXEL Device using this service.
Secured Client IP	A secured client is a “trusted” computer that is allowed to communicate with the ZyXEL Device using this service. Select **All** to allow any computer to access the ZyXEL Device using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the ZyXEL Device using this service.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

19.8 SNMP

Simple Network Management Protocol (SNMP) is a protocol used for exchanging management information between network devices. SNMP is a member of the TCP/IP protocol suite. Your ZyXEL Device supports SNMP agent functionality, which allows a manager station to manage and monitor the ZyXEL Device through the network. The ZyXEL Device supports SNMP version one (SNMPv1) and version two (SNMPv2). The next figure illustrates an SNMP management operation.

SNMP is only available if TCP/IP is configured.

Figure 158 SNMP Management Model



An SNMP managed network consists of two main types of component: agents and a manager.

An agent is a management software module that resides in a managed device (the ZyXEL Device). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a device. Examples of variables include such as number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

- Get - Allows the manager to retrieve an object variable from the agent.
- GetNext - Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPv1, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
- Set - Allows the manager to set values for object variables within an agent.
- Trap - Used by the agent to inform the manager of some events.

19.8.1 Supported MIBs

The ZyXEL Device supports MIB II, which is defined in RFC-1213 and RFC-1215. The focus of the MIBs is to let administrators collect statistical data and monitor status and performance.

19.8.2 SNMP Traps

The ZyXEL Device will send traps to the SNMP manager when any one of the following events occurs:

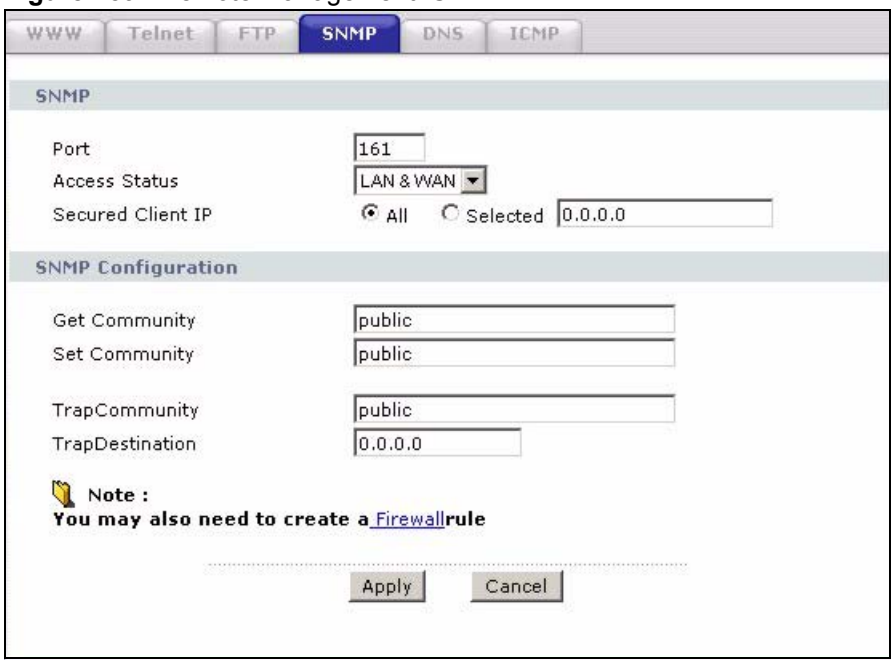
Table 108 SNMP Traps

TRAP #	TRAP NAME	DESCRIPTION
0	coldStart (defined in *RFC-1215*)	A trap is sent after booting (power on).
1	warmStart (defined in *RFC-1215*)	A trap is sent after booting (software reboot).
4	authenticationFailure (defined in *RFC-1215*)	A trap is sent to the manager when receiving any SNMP get or set requirements with the wrong community (password).
6	whyReboot (defined in ZYXEL-MIB)	A trap is sent with the reason of restart before rebooting when the system is going to restart (warm start).
6a	For intentional reboot:	A trap is sent with the message "System reboot by user!" if reboot is done intentionally, (for example, download new files, CI command "sys reboot", etc.).
6b	For fatal error:	A trap is sent with the message of the fatal code if the system reboots because of fatal errors.

19.8.3 Configuring SNMP

To change your ZyXEL Device's SNMP settings, click **Advanced > Remote MGMT** > **SNMP**. The screen appears as shown.

Figure 159 Remote Management: SNMP



The following table describes the labels in this screen.

Table 109 Remote Management: SNMP

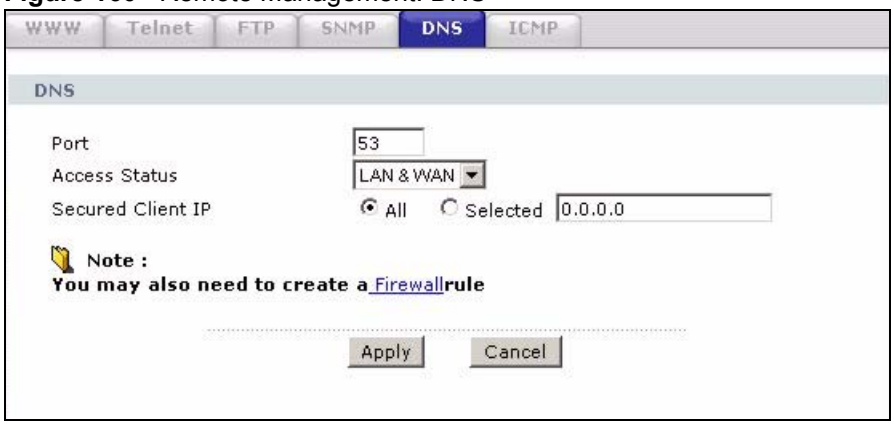
LABEL	DESCRIPTION
SNMP	
Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Access Status	Select the interface(s) through which a computer may access the ZyXEL Device using this service.
Secured Client IP	A secured client is a “trusted” computer that is allowed to communicate with the ZyXEL Device using this service. Select **All** to allow any computer to access the ZyXEL Device using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the ZyXEL Device using this service.
SNMP Configuration	
Get Community	Enter the **Get Community**, which is the password for the incoming Get and GetNext requests from the management station. The default is public and allows all requests.
Set Community	Enter the **Set community**, which is the password for incoming Set requests from the management station. The default is public and allows all requests.
Trap	
Community	Type the trap community, which is the password sent with each trap to the SNMP manager. The default is public and allows all requests.
Destination	Type the IP address of the station to send your SNMP traps to.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

19.9 Configuring DNS

Use DNS (Domain Name System) to map a domain name to its corresponding IP address and vice versa. Refer to Chapter 7 on page 89 for background information.

Click **Advanced > Remote MGMT** > **DNS** to change your ZyXEL Device’s DNS settings. Use this screen to set from which IP address the ZyXEL Device will accept DNS queries and on which interface it can send them your ZyXEL Device’s DNS settings. This feature is not available when the ZyXEL Device is set to bridge mode.

Figure 160 Remote Management: DNS



The following table describes the labels in this screen.

Table 110 Remote Management: DNS

LABEL	DESCRIPTION
Port	The DNS service port number is 53 and cannot be changed here.
Access Status	Select the interface(s) through which a computer may send DNS queries to the ZyXEL Device.
Secured Client IP	A secured client is a “trusted” computer that is allowed to send DNS queries to the ZyXEL Device. Select **All** to allow any computer to send DNS queries to the ZyXEL Device. Choose **Selected** to just allow the computer with the IP address that you specify to send DNS queries to the ZyXEL Device.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

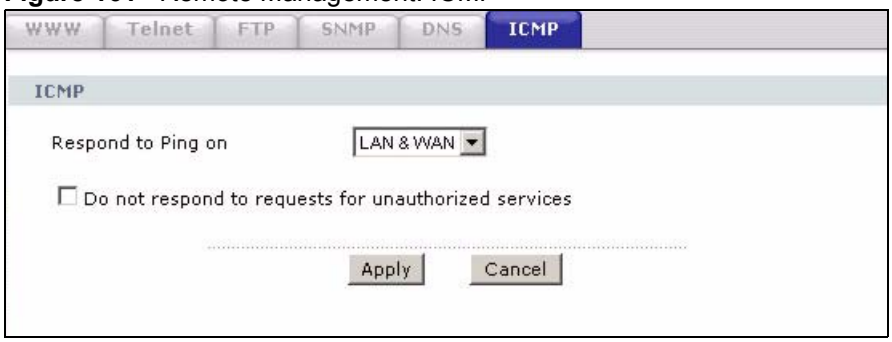
19.10 Configuring ICMP

To change your ZyXEL Device’s security settings, click **Advanced > Remote MGMT** > **ICMP**. The screen appears as shown.

If an outside user attempts to probe an unsupported port on your ZyXEL Device, an ICMP response packet is automatically returned. This allows the outside user to know the ZyXEL Device exists. Your ZyXEL Device supports anti-probing, which prevents the ICMP response packet from being sent. This keeps outsiders from discovering your ZyXEL Device when unsupported ports are probed.

If you want your device to respond to pings and requests for unauthorized services, you may also need to configure the firewall anti probing settings to match.

Figure 161 Remote Management: ICMP



The following table describes the labels in this screen.

Table 111 Remote Management: ICMP

LABEL	DESCRIPTION
ICMP	Internet Control Message Protocol is a message control and error-reporting protocol between a host server and a gateway to the Internet. ICMP uses Internet Protocol (IP) datagrams, but the messages are processed by the TCP/IP software and directly apparent to the application user.
Respond to Ping on	The ZyXEL Device will not respond to any incoming Ping requests when **Disable** is selected. Select **LAN** to reply to incoming LAN Ping requests. Select **WAN** to reply to incoming WAN Ping requests. Otherwise select **LAN & WAN** to reply to both incoming LAN and WAN Ping requests.
Do not respond to requests for unauthorized services	Select this option to prevent hackers from finding the ZyXEL Device by probing for unused ports. If you select this option, the ZyXEL Device will not respond to port request(s) for unused ports, thus leaving the unused ports and the ZyXEL Device unseen. If this option is not selected, the ZyXEL Device will reply with an ICMP port unreachable packet for a port probe on its unused UDP ports and a TCP reset packet for a port probe on its unused TCP ports. Note that the probing packets must first traverse the ZyXEL Device's firewall rule checks before reaching this anti-probing mechanism. Therefore if a firewall rule stops a probing packet, the ZyXEL Device reacts based on the firewall rule to either send a TCP reset packet for a blocked TCP packet (or an ICMP port-unreachable packet for a blocked UDP packets) or just drop the packets without sending a response packet.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to begin configuring this screen afresh.

20

Universal Plug-and-Play (UPnP)

This chapter introduces the UPnP feature in the web configurator.

20.1 Introducing Universal Plug and Play

Universal Plug and Play (UPnP) is a distributed, open networking standard that uses TCP/IP for simple peer-to-peer network connectivity between devices. A UPnP device can dynamically join a network, obtain an IP address, convey its capabilities and learn about other devices on the network. In turn, a device can leave a network smoothly and automatically when it is no longer in use.

See Section 20.2.1 on page 272 for configuration instructions.

20.1.1 How do I know if I'm using UPnP?

UPnP hardware is identified as an icon in the Network Connections folder (Windows XP). Each UPnP compatible device installed on your network will appear as a separate icon. Selecting the icon of a UPnP device will allow you to access the information and properties of that device.

20.1.2 NAT Traversal

UPnP NAT traversal automates the process of allowing an application to operate through NAT. UPnP network devices can automatically configure network addressing, announce their presence in the network to other UPnP devices and enable exchange of simple product and service descriptions. NAT traversal allows the following:

- Dynamic port mapping
- Learning public IP addresses
- Assigning lease times to mappings

Windows Messenger is an example of an application that supports NAT traversal and UPnP.

See the NAT chapter for more information on NAT.

20.1.3 Cautions with UPnP

The automated nature of NAT traversal applications in establishing their own services and opening firewall ports may present network security issues. Network information and configuration may also be obtained and modified by users in some network environments.

When a UPnP device joins a network, it announces its presence with a multicast message. For security reasons, the ZyXEL Device allows multicast messages on the LAN only.

All UPnP-enabled devices may communicate freely with each other without additional configuration. Disable UPnP if this is not your intention.

20.2 UPnP and ZyXEL

ZyXEL has achieved UPnP certification from the Universal Plug and Play Forum UPnP™ Implementers Corp. (UIC). ZyXEL's UPnP implementation supports Internet Gateway Device (IGD) 1.0.

See the following sections for examples of installing and using UPnP.

20.2.1 Configuring UPnP

Click **Advanced > UPnP** to display the screen shown next.

See Section 20.1 on page 271 for more information.

Figure 162 Configuring UPnP

General
UPnP Setup
Device Name: ZyXEL P2802HWL-I1 Internet Sharing Gateway
Active the Universal Plug and Play(UPnP) Feature
Allow users to make configuration changes through UPnP
Note :
For UPnP to function normally, the HTTP service must be available for LAN computers using UPnP.
Apply
Cancel

The following table describes the fields in this screen.

Table 112 Configuring UPnP

LABEL	DESCRIPTION
Active the Universal Plug and Play (UPnP) Feature	Select this check box to activate UPnP. Be aware that anyone could use a UPnP application to open the web configurator's login screen without entering the ZyXEL Device's IP address (although you must still enter the password to access the web configurator).
Allow users to make configuration changes through UPnP	Select this check box to allow UPnP-enabled applications to automatically configure the ZyXEL Device so that they can communicate through the ZyXEL Device, for example by using NAT traversal, UPnP applications automatically reserve a NAT forwarding port in order to communicate with another UPnP enabled device; this eliminates the need to manually configure port forwarding for the UPnP enabled application.

Table 112 Configuring UPnP

LABEL	DESCRIPTION
Apply	Click **Apply** to save the setting to the ZyXEL Device.
Cancel	Click **Cancel** to return to the previously saved settings.

20.3 Installing UPnP in Windows Example

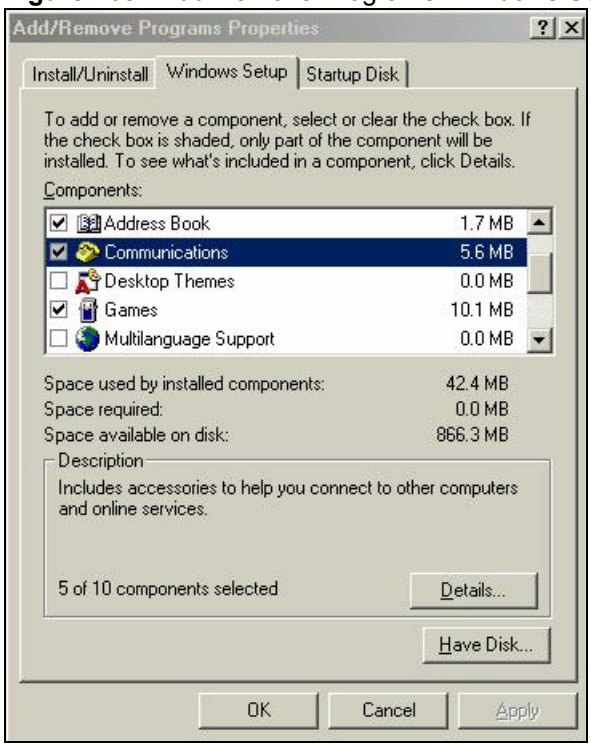
This section shows how to install UPnP in Windows Me and Windows XP.

Installing UPnP in Windows Me

Follow the steps below to install the UPnP in Windows Me.

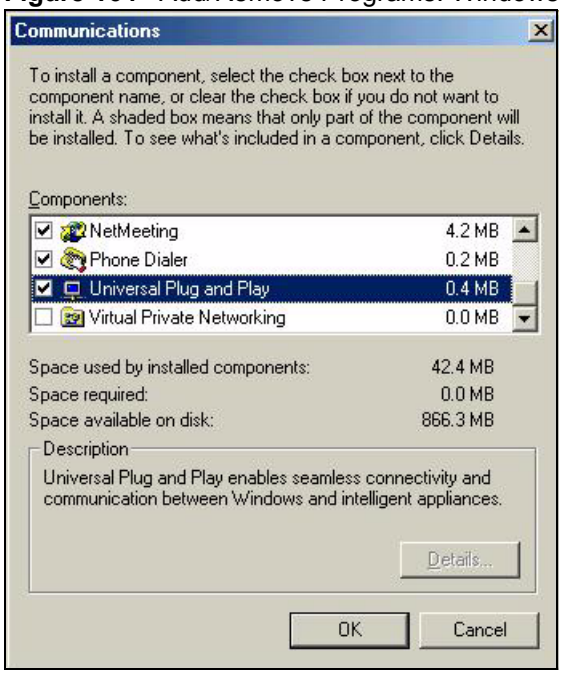
1. Click **Start** and **Control Panel**. Double-click **Add/Remove Programs**.
2. Click on the **Windows Setup** tab and select **Communication** in the **Components** selection box. Click **Details**.

Figure 163 Add/Remove Programs: Windows Setup: Communication


Add/Remove Programs Properties
Install/Uninstall
Windows Setup
Startup Disk
To add or remove a component, select or clear the check box. If the check box is shaded, only part of the component will be installed. To see what's included in a component, click Details.
Components:
Address Book 1.7 MB
Communications 5.6 MB
Desktop Themes 0.0 MB
Games 10.1 MB
Multilanguage Support 0.0 MB
Space used by installed components: 42.4 MB
Space required: 0.0 MB
Space available on disk: 866.3 MB
Description
Includes accessories to help you connect to other computers and online services.
5 of 10 components selected
Details...
Have Disk...
OK
Cancel
Apply

3. In the **Communications** window, select the **Universal Plug and Play** check box in the **Components** selection box.

Figure 164 Add/Remove Programs: Windows Setup: Communication: Components


Communications
To install a component, select the check box next to the component name, or clear the check box if you do not want to install it. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.
Components:
NetMeeting 4.2 MB
Phone Dialer 0.2 MB
Universal Plug and Play 0.4 MB
Virtual Private Networking 0.0 MB
Space used by installed components: 42.4 MB
Space required: 0.0 MB
Space available on disk: 866.3 MB
Description
Universal Plug and Play enables seamless connectivity and communication between Windows and intelligent appliances.
Details...
OK
Cancel

4 Click **OK** to go back to the **Add/Remove Programs Properties** window and click **Next**.

5 Restart the computer when prompted.

Installing UPnP in Windows XP

Follow the steps below to install the UPnP in Windows XP.

1 Click **Start** and **Control Panel**.

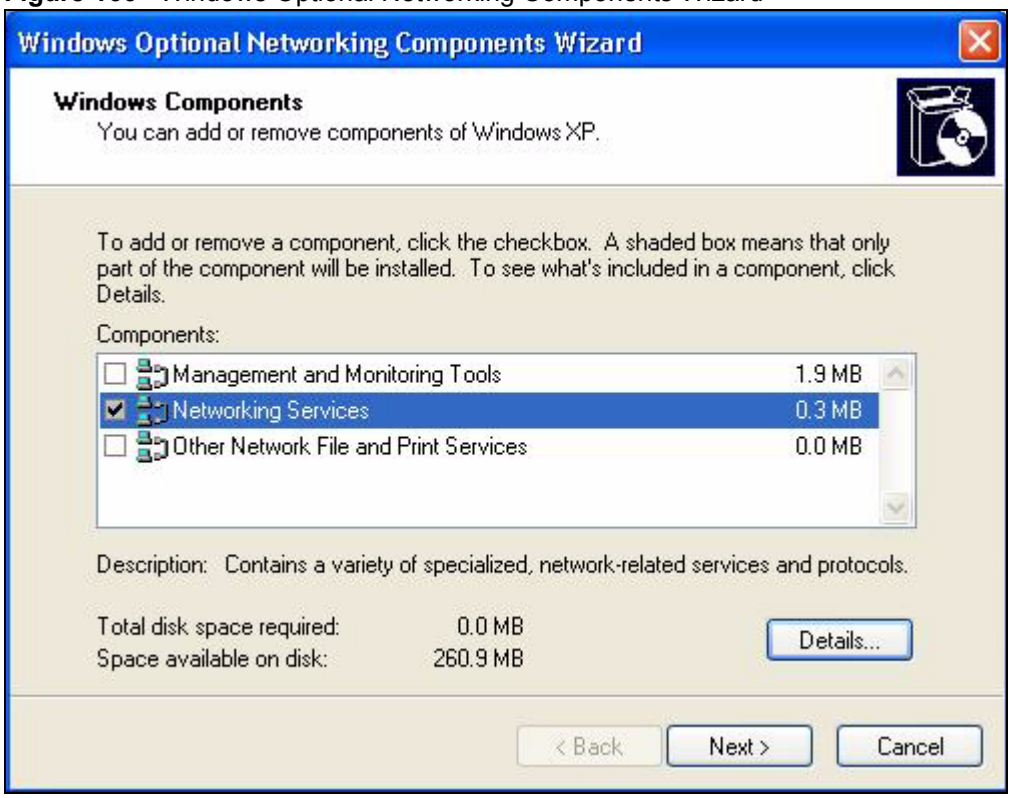
2 Double-click **Network Connections**.

3 In the **Network Connections** window, click **Advanced** in the main menu and select **Optional Networking Components ….**

Figure 165 Network Connections

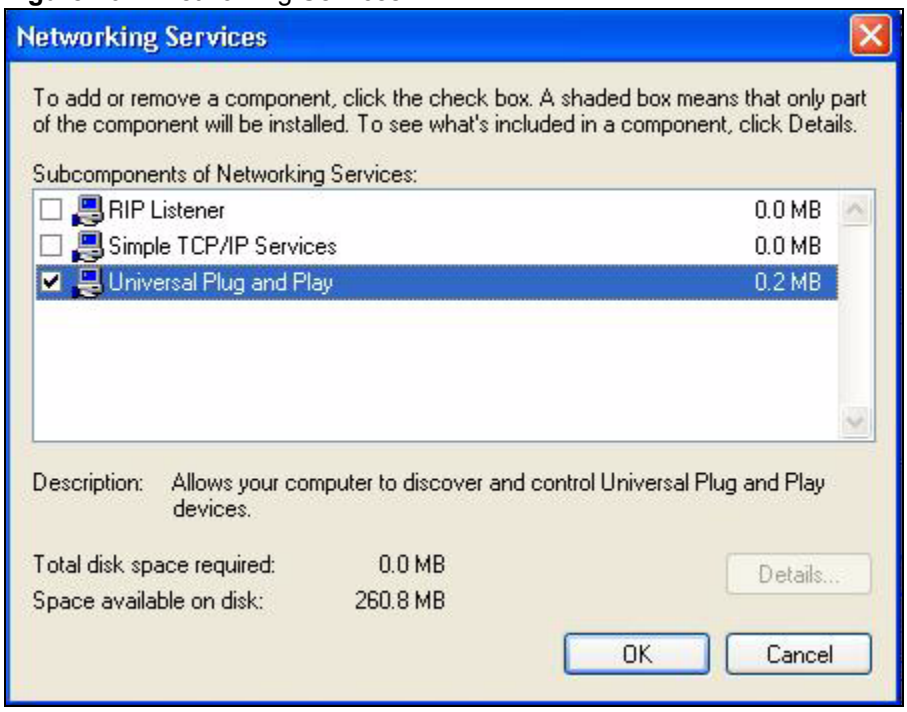
4 The **Windows Optional Networking Components Wizard** window displays. Select **Networking Service** in the **Components** selection box and click **Details**.

Figure 166 Windows Optional Networking Components Wizard


Windows Optional Networking Components Wizard
Windows Components
You can add or remove components of Windows XP.
To add or remove a component, click the checkbox. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.
Components:
Management and Monitoring Tools 1.9 MB
Networking Services 0.3 MB
Other Network File and Print Services 0.0 MB
Description: Contains a variety of specialized, network-related services and protocols.
Total disk space required: 0.0 MB
Space available on disk: 260.9 MB
Details...
< Back
Next >
Cancel

5 In the **Networking Services** window, select the **Universal Plug and Play** check box.

Figure 167 Networking Services


Networking Services
To add or remove a component, click the check box. A shaded box means that only part of the component will be installed. To see what's included in a component, click Details.
Subcomponents of Networking Services:
RIP Listener 0.0 MB
Simple TCP/IP Services 0.0 MB
Universal Plug and Play 0.2 MB
Description: Allows your computer to discover and control Universal Plug and Play devices.
Total disk space required: 0.0 MB
Space available on disk: 260.8 MB
Details...
OK
Cancel

6 Click **OK** to go back to the **Windows Optional Networking Component Wizard** window and click **Next**.

20.4 Using UPnP in Windows XP Example

This section shows you how to use the UPnP feature in Windows XP. You must already have UPnP installed in Windows XP and UPnP activated on the ZyXEL Device.

Make sure the computer is connected to a LAN port of the ZyXEL Device. Turn on your computer and the ZyXEL Device.

Auto-discover Your UPnP-enabled Network Device

1. Click **Start** and **Control Panel**. Double-click **Network Connections**. An icon displays under Internet Gateway.
2. Right-click the icon and select **Properties**.

Figure 168 Network Connections

3. In the **Internet Connection Properties** window, click **Settings** to see the port mappings there were automatically created.

Figure 169 Internet Connection Properties

Internet Connection Properties
General
Connect to the Internet using:
Internet Connection
This connection allows you to connect to the Internet through a shared connection on another computer.
Settings...
Show icon in notification area when connected
OK
Cancel

4 You may edit or delete the port mappings or click **Add** to manually add port mappings.

Figure 170 Internet Connection Properties: Advanced Settings

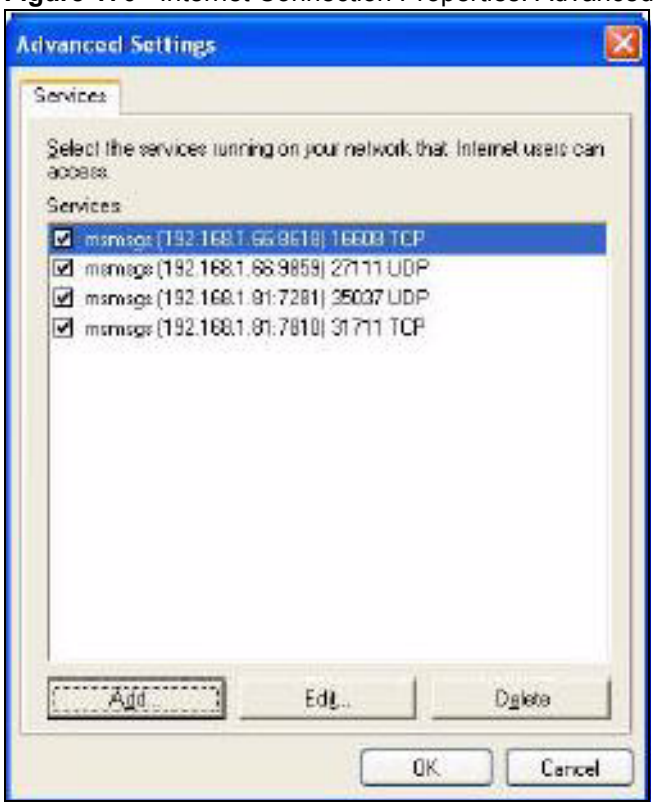
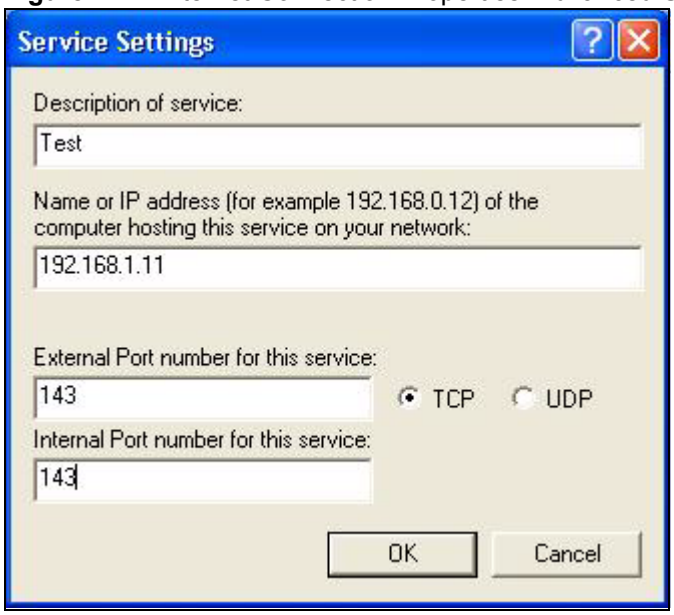


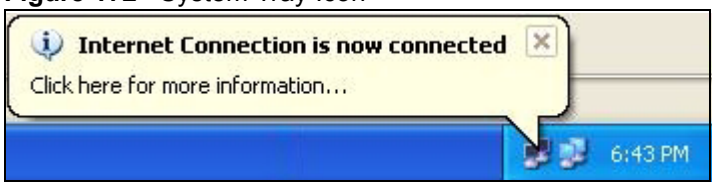
Figure 171 Internet Connection Properties: Advanced Settings: Add



5 When the UPnP-enabled device is disconnected from your computer, all port mappings will be deleted automatically.

6 Select **Show icon in notification area when connected** option and click **OK**. An icon displays in the system tray.

Figure 172 System Tray Icon



7 Double-click on the icon to display your current Internet connection status.

Figure 173 Internet Connection Status

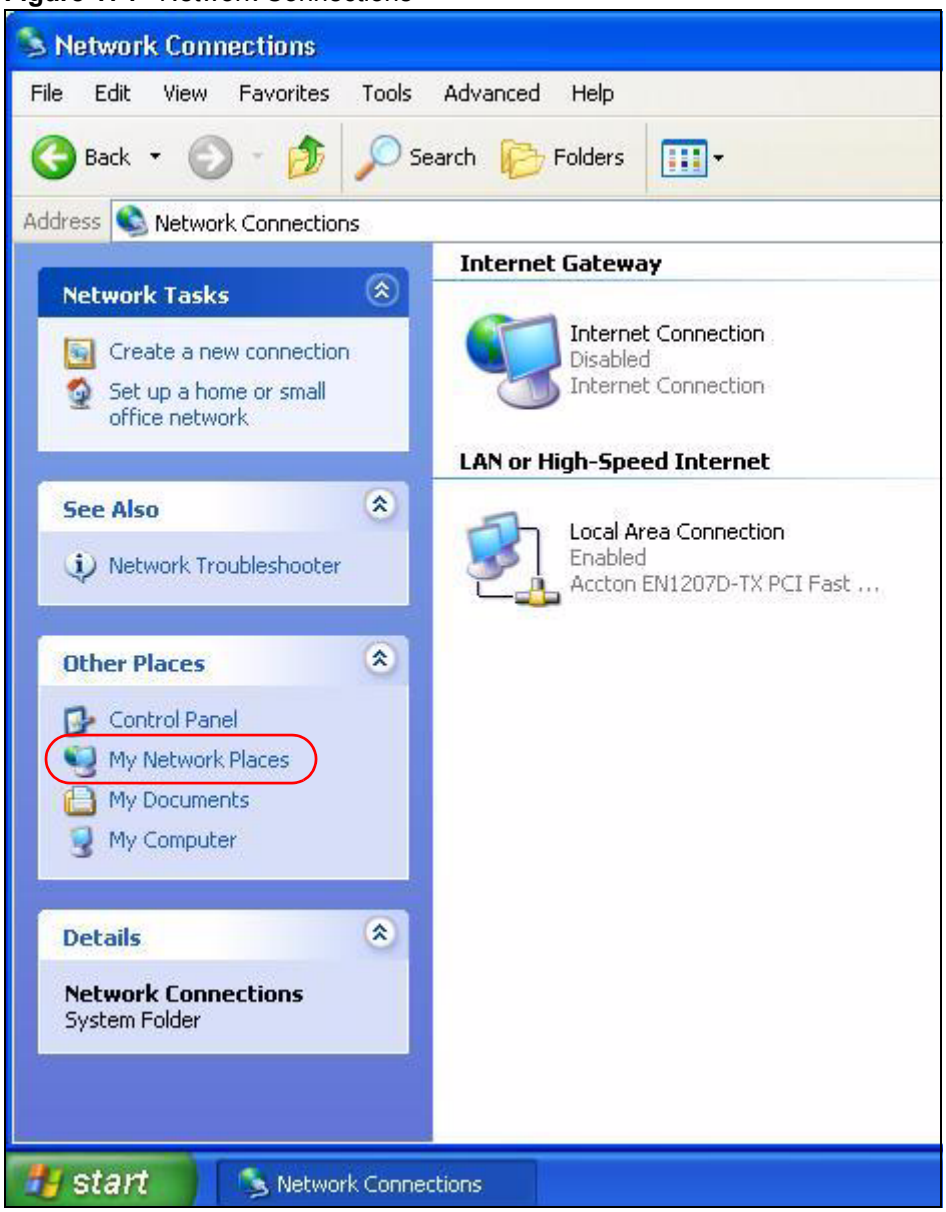
Web Configurator Easy Access

With UPnP, you can access the web-based configurator on the ZyXEL Device without finding out the IP address of the ZyXEL Device first. This comes helpful if you do not know the IP address of the ZyXEL Device.

Follow the steps below to access the web configurator.

1 Click **Start** and then **Control Panel**.
2 Double-click **Network Connections**.
3 Select **My Network Places** under **Other Places**.

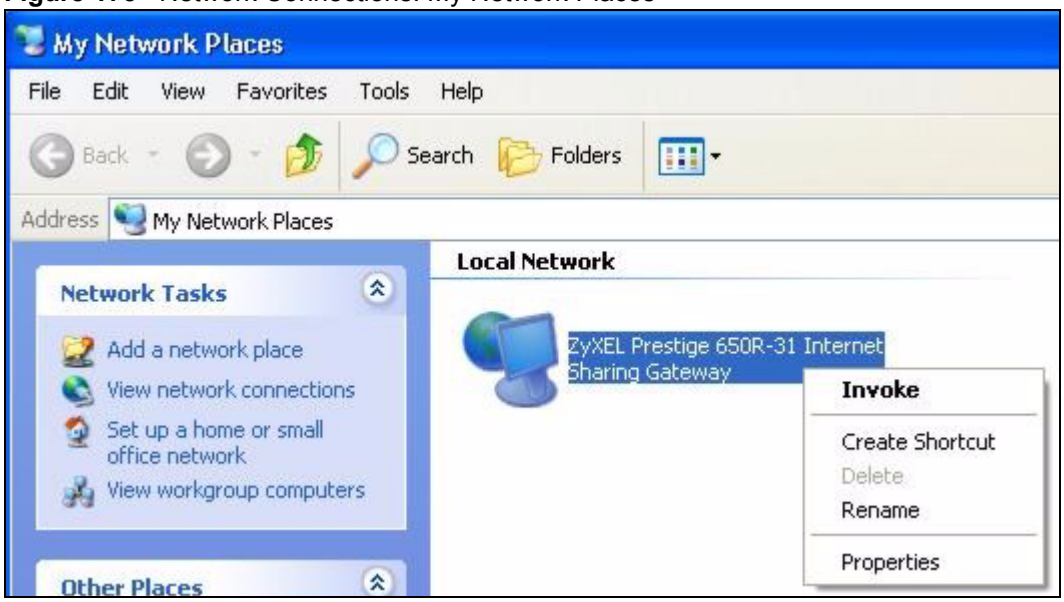
Figure 174 Network Connections



4 An icon with the description for each UPnP-enabled device displays under **Local Network**.

5 Right-click on the icon for your ZyXEL Device and select **Invoke**. The web configurator login screen displays.

Figure 175 Network Connections: My Network Places



6 Right-click on the icon for your ZyXEL Device and select **Properties**. A properties window displays with basic information about the ZyXEL Device.

Figure 176 Network Connections: My Network Places: Properties: Example

PART IV
Maintenance, Troubleshooting and Specifications

System (285)
Logs (289)
Tools (303)
Diagnostic (315)
Troubleshooting (317)
Product Specifications (325)

21 System

Use this screen to configure the ZyXEL Device's time and date settings.

21.1 General Setup and System Name

General Setup contains administrative and system-related information. **System Name** is for identification purposes. However, because some ISPs check this name you should enter your computer's "Computer Name".

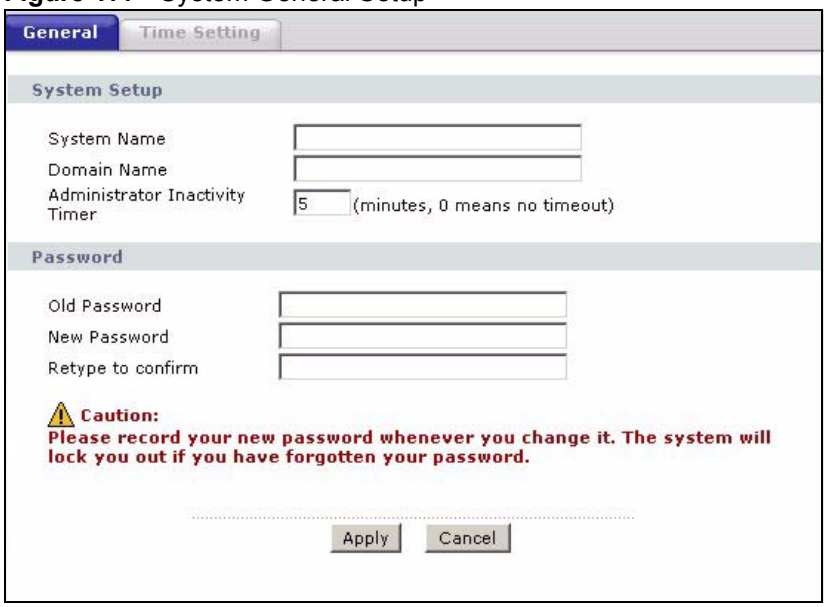
- In Windows 95/98 click **Start**, **Settings**, **Control Panel**, **Network**. Click the Identification tab, note the entry for the **Computer Name** field and enter it as the **System Name**.
- In Windows 2000, click **Start**, **Settings**, **Control Panel** and then double-click **System**. Click the **Network Identification** tab and then the **Properties** button. Note the entry for the **Computer name** field and enter it as the **System Name**.
- In Windows XP, click **start**, **My Computer**, **View system information** and then click the **Computer Name** tab. Note the entry in the **Full computer name** field and enter it as the ZyXEL Device **System Name**.

21.1.1 General Setup

The **Domain Name** entry is what is propagated to the DHCP clients on the LAN. If you leave this blank, the domain name obtained by DHCP from the ISP is used. While you must enter the host name (System Name), the domain name can be assigned from the ZyXEL Device via DHCP.

Click **Maintenance > System** to open the **General** screen.

Figure 177 System General Setup



The following table describes the labels in this screen.

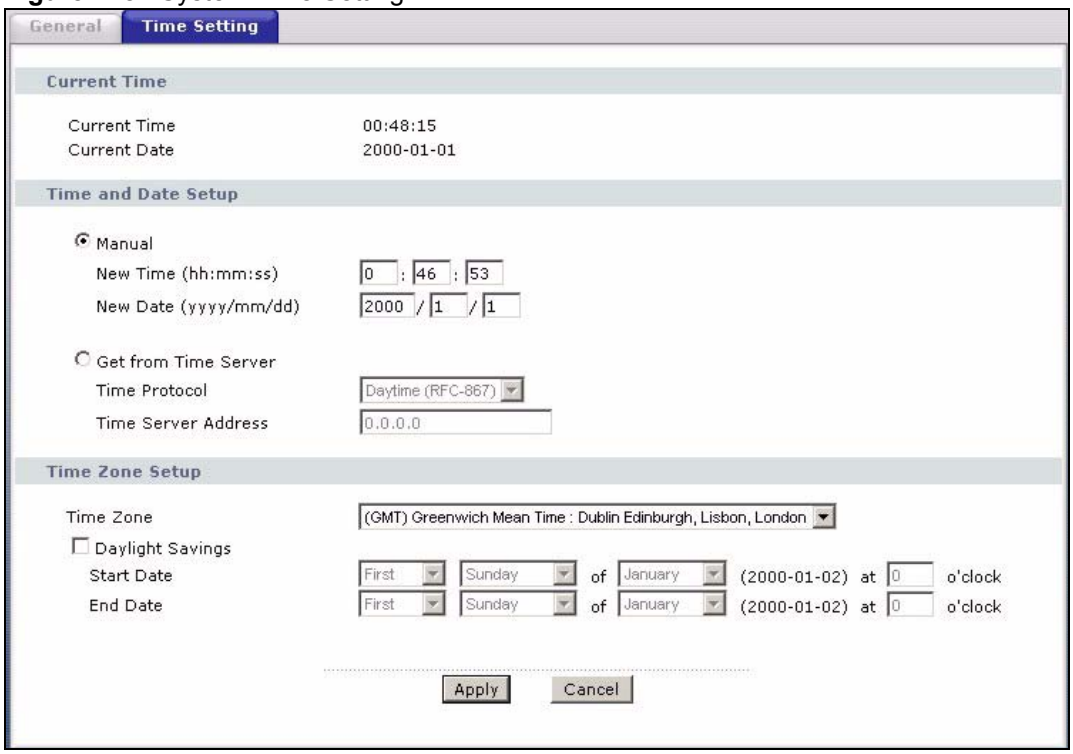
Table 113 System General Setup

LABEL	DESCRIPTION
General Setup	
System Name	Choose a descriptive name for identification purposes. It is recommended you enter your computer's "Computer name" in this field. This name can be up to 30 alphanumeric characters long. Spaces are not allowed, but dashes "-" and underscores "_" are accepted.
Domain Name	Enter the domain name (if you know it) here. If you leave this field blank, the ISP may assign a domain name via DHCP. The domain name entered by you is given priority over the ISP assigned domain name.
Administrator Inactivity Timer	Type how many minutes a management session (either via the web configurator or telnet) can be left idle before the session times out. The default is 5 minutes. After it times out you have to log in with your password again. Very long idle timeouts may have security risks. A value of "0" means a management session never times out, no matter how long it has been left idle (not recommended).
Password	
Old Password	Type the default password or the existing password you use to access the system in this field.
New Password	Type your new system password (up to 30 characters). Note that as you type a password, the screen displays a (*) for each character you type. After you change the password, use the new password to access the ZyXEL Device.
Retype to Confirm	Type the new password again for confirmation.
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

21.2 Time Setting

To change your ZyXEL Device's time and date, click **Maintenance > System > Time Setting**. The screen appears as shown. Use this screen to configure the ZyXEL Device's time based on your local time zone.

Figure 178 System Time Setting



The following table describes the fields in this screen.

Table 114 System Time Setting

LABEL	DESCRIPTION
Current Time	
Current Time	This field displays the time of your ZyXEL Device. Each time you reload this page, the ZyXEL Device synchronizes the time with the time server.
Current Date	This field displays the date of your ZyXEL Device. Each time you reload this page, the ZyXEL Device synchronizes the date with the time server.
Time and Date Setup	
Manual	Select this radio button to enter the time and date manually. If you configure a new time and date, Time Zone and Daylight Saving at the same time, the new time and date you entered has priority and the Time Zone and Daylight Saving settings do not affect it.
New Time (hh:mm:ss)	This field displays the last updated time from the time server or the last time configured manually. When you set **Time and Date Setup** to **Manual**, enter the new time in this field and then click **Apply**.

Table 114 System Time Setting (continued)

LABEL	DESCRIPTION
New Date (yyyy/mm/dd)	This field displays the last updated date from the time server or the last date configured manually. When you set **Time and Date Setup** to **Manual**, enter the new date in this field and then click **Apply**.
Get from Time Server	Select this radio button to have the ZyXEL Device get the time and date from the time server you specified below.
Time Protocol	Select the time service protocol that your time server sends when you turn on the ZyXEL Device. Not all time servers support all protocols, so you may have to check with your ISP/network administrator or use trial and error to find a protocol that works. The main difference between them is the format. **Daytime (RFC 867)** format is day/month/year/time zone of the server. **Time (RFC 868)** format displays a 4-byte integer giving the total number of seconds since 1970/1/1 at 0:0:0. The default, **NTP (RFC 1305)**, is similar to Time (RFC 868).
Time Server Address	Enter the IP address or URL (up to 20 extended ASCII characters in length) of your time server. Check with your ISP/network administrator if you are unsure of this information.
Time Zone Setup	
Time Zone	Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).
Daylight Savings	Daylight saving is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening. Select this option if you use Daylight Saving Time.
Start Date	Configure the day and time when Daylight Saving Time starts if you selected **Daylight Savings**. The **o'clock** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time starts in most parts of the United States on the second Sunday of March. Each time zone in the United States starts using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **Second**, **Sunday**, **March** and **2:00**. Daylight Saving Time starts in the European Union on the last Sunday of March. All of the time zones in the European Union start using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **March**. The time you type in the **o'clock** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
End Date	Configure the day and time when Daylight Saving Time ends if you selected **Daylight Savings**. The **o'clock** field uses the 24 hour format. Here are a couple of examples: Daylight Saving Time ends in the United States on the first Sunday of November. Each time zone in the United States stops using Daylight Saving Time at 2 A.M. local time. So in the United States you would select **First**, **Sunday**, **November** and **2:00**. Daylight Saving Time ends in the European Union on the last Sunday of October. All of the time zones in the European Union stop using Daylight Saving Time at the same moment (1 A.M. GMT or UTC). So in the European Union you would select **Last**, **Sunday**, **October**. The time you type in the **o'clock** field depends on your time zone. In Germany for instance, you would type 2 because Germany's time zone is one hour ahead of GMT or UTC (GMT+1).
Apply	Click **Apply** to save your changes back to the ZyXEL Device.
Cancel	Click **Cancel** to begin configuring this screen afresh.

22 Logs

This chapter contains information about configuring general log settings and viewing the ZyXEL Device's logs.

22.1 Logs Overview

The web configurator allows you to choose which categories of events and/or alerts to have the ZyXEL Device log and then display the logs or have the ZyXEL Device send them to an administrator (as e-mail) or to a syslog server.

22.1.1 Alerts and Logs

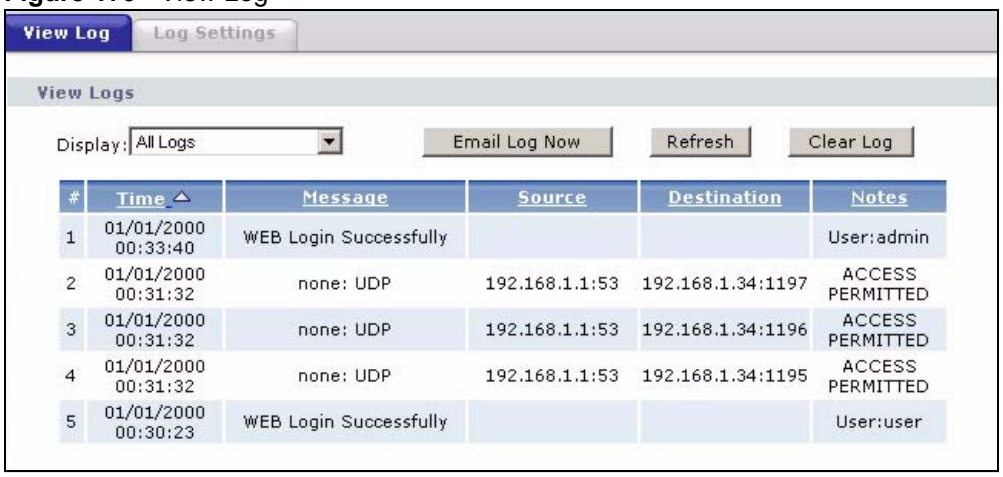
An alert is a type of log that warrants more serious attention. They include system errors, attacks (access control) and attempted access to blocked web sites. Some categories such as **System Errors** consist of both logs and alerts. You may differentiate them by their color in the **View Log** screen. Alerts display in red and logs display in black.

22.2 Viewing the Logs

Click **Maintenance > Logs** to open the **View Log** screen. Use the **View Log** screen to see the logs for the categories that you selected in the **Log Settings** screen (see Section 22.3 on page 290).

Log entries in red indicate alerts. The log wraps around and deletes the old entries after it fills. Click a column heading to sort the entries. A triangle indicates ascending or descending sort order.

Figure 179 View Log


View Log
Log Settings
View Logs
Display: All Logs
Email Log Now
Refresh
Clear Log
Time Message Source Destination Notes
1 01/01/2000 00:33:40 WEB Login Successfully User:admin
2 01/01/2000 00:31:32 none: UDP 192.168.1.1:53 192.168.1.34:1197 ACCESS PERMITTED
3 01/01/2000 00:31:32 none: UDP 192.168.1.1:53 192.168.1.34:1196 ACCESS PERMITTED
4 01/01/2000 00:31:32 none: UDP 192.168.1.1:53 192.168.1.34:1195 ACCESS PERMITTED
5 01/01/2000 00:30:23 WEB Login Successfully User:user

The following table describes the fields in this screen.

Table 115 View Log

LABEL	DESCRIPTION
Display	The categories that you select in the **Log Settings** screen display in the drop-down list box. Select a category of logs to view; select **All Logs** to view logs from all of the log categories that you selected in the **Log Settings** page.
Email Log Now	Click **Email Log Now** to send the log screen to the e-mail address specified in the **Log Settings** page (make sure that you have first filled in the **E-mail Log Settings** fields in **Log Settings**).
Refresh	Click **Refresh** to renew the log screen.
Clear Log	Click **Clear Log** to delete all the logs.
#	This field is a sequential value and is not associated with a specific entry.
Time	This field displays the time the log was recorded.
Message	This field states the reason for the log.
Source	This field lists the source IP address and the port number of the incoming packet.
Destination	This field lists the destination IP address and the port number of the incoming packet.
Notes	This field displays additional information about the log entry.

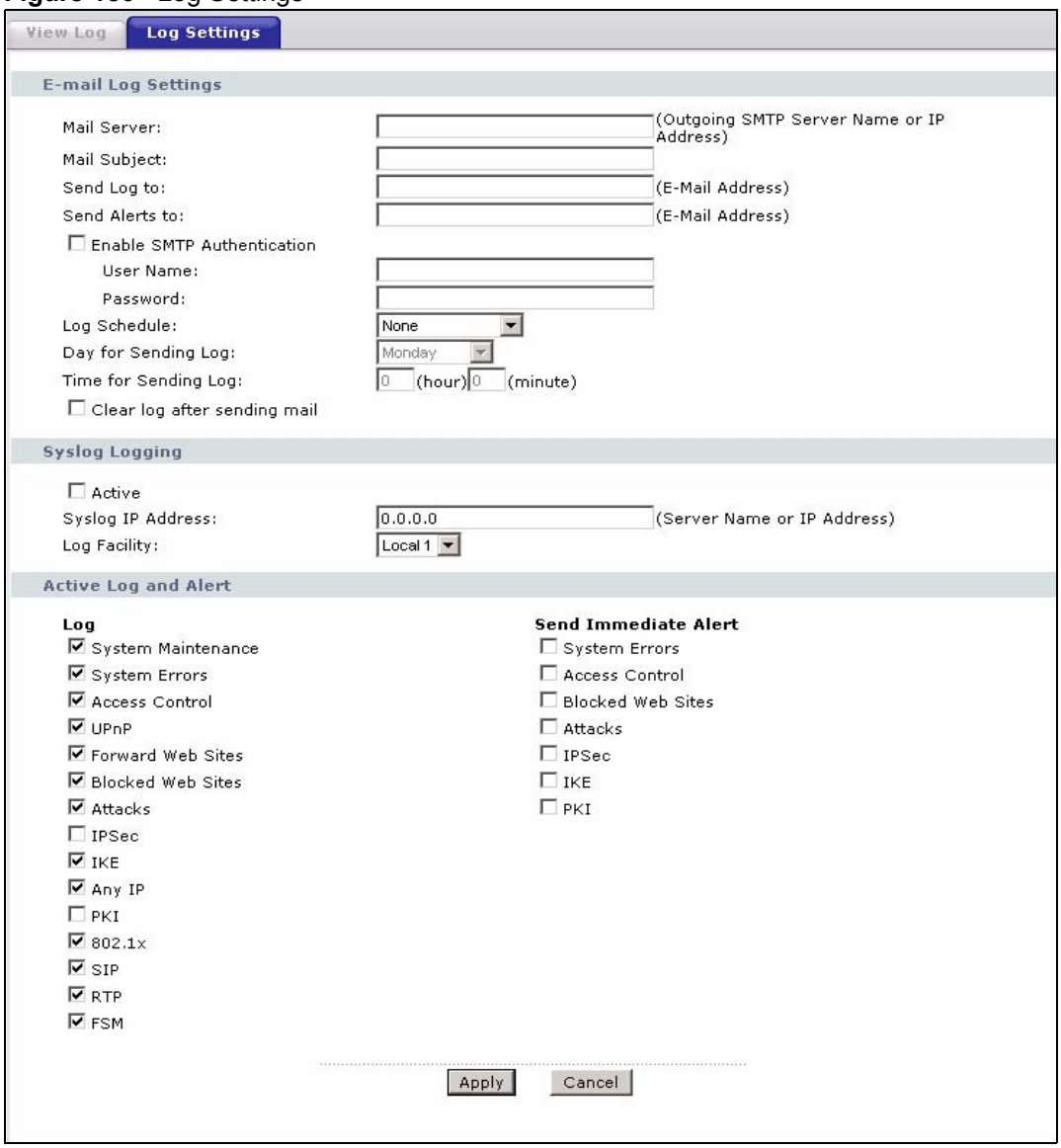
22.3 Configuring Log Settings

Use the **Log Settings** screen to configure to where the ZyXEL Device is to send logs; the schedule for when the ZyXEL Device is to send the logs and which logs and/or immediate alerts the ZyXEL Device is to record. See Section 22.1 on page 289 for more information.

To change your ZyXEL Device's log settings, click **Maintenance > Logs** > **Log Settings**. The screen appears as shown.

Alerts are e-mailed as soon as they happen. Logs may be e-mailed as soon as the log is full. Selecting many alert and/or log categories (especially **Access Control**) may result in many e-mails being sent.

Figure 180 Log Settings



The following table describes the fields in this screen.

Table 116 Log Settings

LABEL	DESCRIPTION
E-mail Log Settings	
Mail Server	Enter the server name or the IP address of the mail server for the e-mail addresses specified below. If this field is left blank, logs and alert messages will not be sent via E-mail.
Mail Subject	Type a title that you want to be in the subject line of the log e-mail message that the ZyXEL Device sends. Not all ZyXEL Device models have this field.
Send Log to	The ZyXEL Device sends logs to the e-mail address specified in this field. If this field is left blank, the ZyXEL Device does not send logs via e-mail.

Table 116 Log Settings

LABEL	DESCRIPTION
Send Alerts to	Alerts are real-time notifications that are sent as soon as an event, such as a DoS attack, system error, or forbidden web access attempt occurs. Enter the E-mail address where the alert messages will be sent. Alerts include system errors, attacks and attempted access to blocked web sites. If this field is left blank, alert messages will not be sent via E-mail.
Enable SMTP Authentication	SMTP (Simple Mail Transfer Protocol) is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another. Select the check box to activate SMTP authentication. If mail server authentication is needed but this feature is disabled, you will not receive the e-mail logs.
User Name	Enter the user name (up to 31 characters) (usually the user name of a mail account).
Password	Enter the password associated with the user name above.
Log Schedule	This drop-down menu is used to configure the frequency of log messages being sent as E-mail: • Daily • Weekly • Hourly • When Log is Full • None. If you select **Weekly** or **Daily**, specify a time of day when the E-mail should be sent. If you select **Weekly**, then also specify which day of the week the E-mail should be sent. If you select **When Log is Full**, an alert is sent when the log fills up. If you select **None**, no log messages are sent.
Day for Sending Log	Use the drop down list box to select which day of the week to send the logs.
Time for Sending Log	Enter the time of the day in 24-hour format (for example 23:00 equals 11:00 pm) to send the logs.
Clear log after sending mail	Select the checkbox to delete all the logs after the ZyXEL Device sends an E-mail of the logs.
Syslog Logging	The ZyXEL Device sends a log to an external syslog server.
Active	Click **Active** to enable syslog logging.
Syslog IP Address	Enter the server name or IP address of the syslog server that will log the selected categories of logs.
Log Facility	Select a location from the drop down list box. The log facility allows you to log the messages to different files in the syslog server. Refer to the syslog server manual for more information.
Active Log and Alert	
Log	Select the categories of logs that you want to record.
Send Immediate Alert	Select log categories for which you want the ZyXEL Device to send E-mail alerts immediately.
Apply	Click **Apply** to save your customized settings and exit this screen.
Cancel	Click **Cancel** to return to the previously saved settings.

22.4 SMTP Error Messages

If there are difficulties in sending e-mail the following error message appears.

“SMTP action request failed. ret= ??". The “??"are described in the following table.

Table 117 SMTP Error Messages

-1 means ZyXEL Device out of socket
-2 means tcp SYN fail
-3 means smtp server OK fail
-4 means HELO fail
-5 means MAIL FROM fail
-6 means RCPT TO fail
-7 means DATA fail
-8 means mail data send fail

22.4.1 Example E-mail Log

An "End of Log" message displays for each mail in which a complete log has been sent. The following is an example of a log sent by e-mail.

- You may edit the subject title.
- The date format here is Day-Month-Year.
- The date format here is Month-Day-Year. The time format is Hour-Minute-Second.
- "`End of Log`" message shows that a complete log has been sent.

Figure 181 E-mail Log Example

```
Subject:
        Firewall Alert From
   Date:
        Fri, 07 Apr 2000 10:05:42
   From:
        user@zyxel.com
     To:
        user@zyxel.com
  1|Apr  7 00 |From:192.168.1.1     To:192.168.1.255   |default policy  |forward
   | 09:54:03 |UDP     src port:00520 dest port:00520  |<1,00>          |
  2|Apr  7 00 |From:192.168.1.131   To:192.168.1.255   |default policy  |forward
   | 09:54:17 |UDP     src port:00520 dest port:00520  |<1,00>          |
  3|Apr  7 00 |From:192.168.1.6     To:10.10.10.10 |match           |forward
   | 09:54:19 |UDP     src port:03516 dest port:00053  |<1,01>          |
……..{snip}……..
……..{snip}……..
126|Apr  7 00 |From:192.168.1.1     To:192.168.1.255   |match           |forward
   | 10:05:00 |UDP     src port:00520 dest port:00520  |<1,02>          |
127|Apr  7 00 |From:192.168.1.131   To:192.168.1.255   |match           |forward
   | 10:05:17 |UDP     src port:00520 dest port:00520  |<1,02>          |
128|Apr  7 00 |From:192.168.1.1     To:192.168.1.255   |match           |forward
   | 10:05:30 |UDP     src port:00520 dest port:00520  |<1,02>          |
End of Firewall Log
```

22.5 Log Descriptions

This section provides descriptions of example log messages.

Table 118 System Maintenance Logs

LOG MESSAGE	DESCRIPTION
Time calibration is successful	The router has adjusted its time based on information from the time server.
Time calibration failed	The router failed to get information from the time server.
WAN interface gets IP: %s	A WAN interface got a new IP address from the DHCP, PPPoE, PPTP or dial-up server.
DHCP client IP expired	A DHCP client's IP address has expired.
DHCP server assigns %s	The DHCP server assigned an IP address to a client.
Successful WEB login	Someone has logged on to the router's web configurator interface.
WEB login failed	Someone has failed to log on to the router's web configurator interface.
Successful TELNET login	Someone has logged on to the router via telnet.
TELNET login failed	Someone has failed to log on to the router via telnet.
Successful FTP login	Someone has logged on to the router via ftp.
FTP login failed	Someone has failed to log on to the router via ftp.
NAT Session Table is Full!	The maximum number of NAT session table entries has been exceeded and the table is full.
Starting Connectivity Monitor	Starting Connectivity Monitor.
Time initialized by Daytime Server	The router got the time and date from the Daytime server.
Time initialized by Time server	The router got the time and date from the time server.
Time initialized by NTP server	The router got the time and date from the NTP server.
Connect to Daytime server fail	The router was not able to connect to the Daytime server.
Connect to Time server fail	The router was not able to connect to the Time server.
Connect to NTP server fail	The router was not able to connect to the NTP server.
Too large ICMP packet has been dropped	The router dropped an ICMP packet that was too large.
Configuration Change: PC = 0x%x, Task ID = 0x%x	The router is saving configuration changes.
Successful SSH login	Someone has logged on to the router’s SSH server.
SSH login failed	Someone has failed to log on to the router’s SSH server.
Successful HTTPS login	Someone has logged on to the router's web configurator interface using HTTPS protocol.
HTTPS login failed	Someone has failed to log on to the router's web configurator interface using HTTPS protocol.

Table 119 System Error Logs

LOG MESSAGE	DESCRIPTION
%s exceeds the max. number of session per host!	This attempt to create a NAT session exceeds the maximum number of NAT session table entries allowed to be created per host.
setNetBIOSFilter: calloc error	The router failed to allocate memory for the NetBIOS filter settings.
readNetBIOSFilter: calloc error	The router failed to allocate memory for the NetBIOS filter settings.
WAN connection is down.	A WAN connection is down. You cannot access the network through this interface.

Table 120 Access Control Logs

LOG MESSAGE	DESCRIPTION
Firewall default policy: [TCP | UDP | IGMP | ESP | GRE | OSPF] <Packet Direction>	Attempted TCP/UDP/IGMP/ESP/GRE/OSPF access matched the default policy and was blocked or forwarded according to the default policy's setting.
Firewall rule [NOT] match:[TCP | UDP | IGMP | ESP | GRE | OSPF] <Packet Direction>, <rule:%d>	Attempted TCP/UDP/IGMP/ESP/GRE/OSPF access matched (or did not match) a configured firewall rule (denoted by its number) and was blocked or forwarded according to the rule.
Triangle route packet forwarded: [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall allowed a triangle route session to pass through.
Packet without a NAT table entry blocked: [TCP | UDP | IGMP | ESP | GRE | OSPF]	The router blocked a packet that didn't have a corresponding NAT table entry.
Router sent blocked web site message: TCP	The router sent a message to notify a user that the router blocked access to a web site that the user requested.

Table 121 TCP Reset Logs

LOG MESSAGE	DESCRIPTION
Under SYN flood attack, sent TCP RST	The router sent a TCP reset packet when a host was under a SYN flood attack (the TCP incomplete count is per destination host.)
Exceed TCP MAX incomplete, sent TCP RST	The router sent a TCP reset packet when the number of TCP incomplete connections exceeded the user configured threshold. (the TCP incomplete count is per destination host.) Note: Refer to **TCP Maximum Incomplete** in the **Firewall Attack Alerts** screen.
Peer TCP state out of order, sent TCP RST	The router sent a TCP reset packet when a TCP connection state was out of order.Note: The firewall refers to RFC793 Figure 6 to check the TCP state.
Firewall session time out, sent TCP RST	The router sent a TCP reset packet when a dynamic firewall session timed out.Default timeout values:ICMP idle timeout (s): 60UDP idle timeout (s): 60TCP connection (three way handshaking) timeout (s): 30TCP FIN-wait timeout (s): 60TCP idle (established) timeout (s): 3600

Table 121 TCP Reset Logs (continued)

LOG MESSAGE	DESCRIPTION
Exceed MAX incomplete, sent TCP RST	The router sent a TCP reset packet when the number of incomplete connections (TCP and UDP) exceeded the user-configured threshold. (Incomplete count is for all TCP and UDP connections through the firewall.)Note: When the number of incomplete connections (TCP + UDP) > “Maximum Incomplete High”, the router sends TCP RST packets for TCP connections and destroys TOS (firewall dynamic sessions) until incomplete connections < “Maximum Incomplete Low”.
Access block, sent TCP RST	The router sends a TCP RST packet and generates this log if you turn on the firewall TCP reset mechanism (via CI command: "sys firewall tcprst").

Table 122 Packet Filter Logs

LOG MESSAGE	DESCRIPTION
[TCP | UDP | ICMP | IGMP | Generic] packet filter matched (set: %d, rule: %d)	Attempted access matched a configured filter rule (denoted by its set and rule number) and was blocked or forwarded according to the rule.

For type and code details, see Table 131 on page 299.

Table 123 ICMP Logs

LOG MESSAGE	DESCRIPTION
Firewall default policy: ICMP <Packet Direction>, <type:%d>, <code:%d>	ICMP access matched the default policy and was blocked or forwarded according to the user's setting.
Firewall rule [NOT] match: ICMP <Packet Direction>, <rule:%d>, <type:%d>, <code:%d>	ICMP access matched (or didn’t match) a firewall rule (denoted by its number) and was blocked or forwarded according to the rule.
Triangle route packet forwarded: ICMP	The firewall allowed a triangle route session to pass through.
Packet without a NAT table entry blocked: ICMP	The router blocked a packet that didn’t have a corresponding NAT table entry.
Unsupported/out-of-order ICMP: ICMP	The firewall does not support this kind of ICMP packets or the ICMP packets are out of order.
Router reply ICMP packet: ICMP	The router sent an ICMP reply packet to the sender.

Table 124 CDR Logs

LOG MESSAGE	DESCRIPTION
board %d line %d channel %d, call %d, %s C01 Outgoing Call dev=%x ch=%x %s	The router received the setup requirements for a call. “call” is the reference (count) number of the call. “dev” is the device type (3 is for dial-up, 6 is for PPPoE, 10 is for PPTP). "channel" or “ch” is the call channel ID.For example,"board 0 line 0 channel 0, call 3, C01 Outgoing Call dev=6 ch=0 "Means the router has dialed to the PPPoE server 3 times.

Table 124 CDR Logs (continued)

LOG MESSAGE	DESCRIPTION
`board %d line %d channel %d, call %d, %s C02 OutCall Connected %d %s`	The PPPoE, PPTP or dial-up call is connected.
`board %d line %d channel %d, call %d, %s C02 Call Terminated`	The PPPoE, PPTP or dial-up call was disconnected.

Table 125 PPP Logs

LOG MESSAGE	DESCRIPTION
`ppp:LCP Starting`	The PPP connection's Link Control Protocol stage has started.
`ppp:LCP Opening`	The PPP connection's Link Control Protocol stage is opening.
`ppp:CHAP Opening`	The PPP connection's Challenge Handshake Authentication Protocol stage is opening.
`ppp:IPCP Starting`	The PPP connection's Internet Protocol Control Protocol stage is starting.
`ppp:IPCP Opening`	The PPP connection's Internet Protocol Control Protocol stage is opening.
`ppp:LCP Closing`	The PPP connection's Link Control Protocol stage is closing.
`ppp:IPCP Closing`	The PPP connection's Internet Protocol Control Protocol stage is closing.

Table 126 UPnP Logs

LOG MESSAGE	DESCRIPTION
`UPnP pass through Firewall`	UPnP packets can pass through the firewall.

Table 127 Content Filtering Logs

LOG MESSAGE	DESCRIPTION
`%s: block keyword`	The content of a requested web page matched a user defined keyword.
`%s`	The system forwarded web content.

For type and code details, see Table 131 on page 299.

Table 128 Attack Logs

LOG MESSAGE	DESCRIPTION
`attack [ TCP | UDP | IGMP | ESP | GRE | OSPF ]`	The firewall detected a TCP/UDP/IGMP/ESP/GRE/OSPF attack.
`attack ICMP (type:%d, code:%d)`	The firewall detected an ICMP attack.
`land [ TCP | UDP | IGMP | ESP | GRE | OSPF ]`	The firewall detected a TCP/UDP/IGMP/ESP/GRE/OSPF land attack.
`land ICMP (type:%d, code:%d)`	The firewall detected an ICMP land attack.

Table 128 Attack Logs (continued)

LOG MESSAGE	DESCRIPTION
ip spoofing - WAN [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall detected an IP spoofing attack on the WAN port.
ip spoofing - WAN ICMP (type:%d, code:%d)	The firewall detected an ICMP IP spoofing attack on the WAN port.
icmp echo : ICMP (type:%d, code:%d)	The firewall detected an ICMP echo attack.
syn flood TCP	The firewall detected a TCP syn flood attack.
ports scan TCP	The firewall detected a TCP port scan attack.
teardrop TCP	The firewall detected a TCP teardrop attack.
teardrop UDP	The firewall detected an UDP teardrop attack.
teardrop ICMP (type:%d, code:%d)	The firewall detected an ICMP teardrop attack.
illegal command TCP	The firewall detected a TCP illegal command attack.
NetBIOS TCP	The firewall detected a TCP NetBIOS attack.
ip spoofing - no routing entry [TCP | UDP | IGMP | ESP | GRE | OSPF]	The firewall classified a packet with no source routing entry as an IP spoofing attack.
ip spoofing - no routing entry ICMP (type:%d, code:%d)	The firewall classified an ICMP packet with no source routing entry as an IP spoofing attack.
vulnerability ICMP (type:%d, code:%d)	The firewall detected an ICMP vulnerability attack.
traceroute ICMP (type:%d, code:%d)	The firewall detected an ICMP traceroute attack.

Table 129 802.1X Logs

LOG MESSAGE	DESCRIPTION
Local User Database accepts user.	A user was authenticated by the local user database.
Local User Database reports user credential error.	A user was not authenticated by the local user database because of an incorrect user password.
Local User Database does not find user`s credential.	A user was not authenticated by the local user database because the user is not listed in the local user database.
RADIUS accepts user.	A user was authenticated by the RADIUS Server.
RADIUS rejects user. Pls check RADIUS Server.	A user was not authenticated by the RADIUS Server. Please check the RADIUS Server.
Local User Database does not support authentication method.	The local user database only supports the EAP-MD5 method. A user tried to use another authentication method and was not authenticated.
User logout because of session timeout expired.	The router logged out a user whose session expired.
User logout because of user deassociation.	The router logged out a user who ended the session.

Table 129 802.1X Logs (continued)

LOG MESSAGE	DESCRIPTION
User logout because of no authentication response from user.	The router logged out a user from which there was no authentication response.
User logout because of idle timeout expired.	The router logged out a user whose idle timeout period expired.
User logout because of user request.	A user logged out.
Local User Database does not support authentication method.	A user tried to use an authentication method that the local user database does not support (it only supports EAP-MD5).
No response from RADIUS. Pls check RADIUS Server.	There is no response message from the RADIUS server, please check the RADIUS server.
Use Local User Database to authenticate user.	The local user database is operating as the authentication server.
Use RADIUS to authenticate user.	The RADIUS server is operating as the authentication server.
No Server to authenticate user.	There is no authentication server to authenticate a user.
Local User Database does not find user`s credential.	A user was not authenticated by the local user database because the user is not listed in the local user database.

Table 130 ACL Setting Notes

PACKET DIRECTION	DIRECTION	DESCRIPTION
(L to W)	LAN to WAN	ACL set for packets traveling from the LAN to the WAN.
(W to L)	WAN to LAN	ACL set for packets traveling from the WAN to the LAN.
(L to L/ZyXEL Device)	LAN to LAN/ ZyXEL Device	ACL set for packets traveling from the LAN to the LAN or the ZyXEL Device.
(W to W/ZyXEL Device)	WAN to WAN/ ZyXEL Device	ACL set for packets traveling from the WAN to the WAN or the ZyXEL Device.

Table 131 ICMP Notes

TYPE	CODE	DESCRIPTION
0		Echo Reply
	0	Echo reply message
3		Destination Unreachable
	0	Net unreachable
	1	Host unreachable
	2	Protocol unreachable
	3	Port unreachable
	4	A packet that needed fragmentation was dropped because it was set to Don't Fragment (DF)
	5	Source route failed
4		Source Quench

Table 131 ICMP Notes (continued)

TYPE	CODE	DESCRIPTION
	0	A gateway may discard internet datagrams if it does not have the buffer space needed to queue the datagrams for output to the next network on the route to the destination network.
5		Redirect
	0	Redirect datagrams for the Network
	1	Redirect datagrams for the Host
	2	Redirect datagrams for the Type of Service and Network
	3	Redirect datagrams for the Type of Service and Host
8		Echo
	0	Echo message
11		Time Exceeded
	0	Time to live exceeded in transit
	1	Fragment reassembly time exceeded
12		Parameter Problem
	0	Pointer indicates the error
13		Timestamp
	0	Timestamp request message
14		Timestamp Reply
	0	Timestamp reply message
15		Information Request
	0	Information request message
16		Information Reply
	0	Information reply message

Table 132 Syslog Logs

LOG MESSAGE	DESCRIPTION
<Facility*8 + Severity>Mon dd hr:mm:ss hostname src="<srcIP:srcPort>" dst="<dstIP:dstPort>" msg="<msg>" note="<note>" devID="<mac address last three numbers>" cat="<category>	"This message is sent by the system ("RAS" displays as the system name if you haven't configured one) when the router generates a syslog. The facility is defined in the web MAIN MENU->LOGS->Log Settings page. The severity is the log's syslog class. The definition of messages and notes are defined in the various log charts throughout this appendix. The "devID" is the last three characters of the MAC address of the router's LAN port. The "cat" is the same as the category in the router's logs.

Table 133 SIP Logs

LOG MESSAGE	DESCRIPTION
SIP Registration Success by SIP:SIP Phone Number	The listed SIP account was successfully registered with a SIP register server.
SIP Registration Fail by SIP:SIP Phone Number	An attempt to register the listed SIP account with a SIP register server was not successful.

Table 133 SIP Logs (continued)

LOG MESSAGE	DESCRIPTION
SIP UnRegistration Success by SIP:SIP Phone Number	The listed SIP account's registration was deleted from the SIP register server.
SIP UnRegistration Fail by SIP:SIP Phone Number	An attempt to delete the listed SIP account's registration from the SIP register server failed.

Table 134 RTP Logs

LOG MESSAGE	DESCRIPTION
Error, RTP init fail	The initialization of an RTP session failed.
Error, Call fail: RTP connect fail	A VoIP phone call failed because the RTP session could not be established.
Error, RTP connection cannot close	The termination of an RTP session failed.

Table 135 FSM Logs: Caller Side

LOG MESSAGE	DESCRIPTION
VoIP Call Start Ph[Phone Port Number] <- Outgoing Call Number	Someone used a phone connected to the listed phone port to initiate a VoIP call to the listed destination.
VoIP Call Established Ph[Phone Port] -> Outgoing Call Number	Someone used a phone connected to the listed phone port to make a VoIP call to the listed destination.
VoIP Call End Phone[Phone Port]	A VoIP phone call made from a phone connected to the listed phone port has terminated.

Table 136 FSM Logs: Callee Side

LOG MESSAGE	DESCRIPTION
VoIP Call Start from SIP[SIP Port Number]	A VoIP phone call came to the ZyXEL Device from the listed SIP number.
VoIP Call Established Ph[Phone Port] <- Outgoing Call Number	A VoIP phone call was set up from the listed SIP number to the ZyXEL Device.
VoIP Call End Phone[Phone Port]	A VoIP phone call that came into the ZyXEL Device has terminated.

Table 137 PSTN Logs

LOG MESSAGE	DESCRIPTION
PSTN Call Start	A PSTN call has been initiated.
PSTN Call End	A PSTN call has terminated.
PSTN Call Established	A PSTN call has been set up.

The following table shows RFC-2408 ISAKMP payload types that the log displays. Please refer to RFC 2408 for detailed information on each type.

Table 138 RFC-2408 ISAKMP Payload Types

LOG DISPLAY	PAYLOAD TYPE
SA	Security Association
PROP	Proposal
TRANS	Transform
KE	Key Exchange
ID	Identification
CER	Certificate
CER_REQ	Certificate Request
HASH	Hash
SIG	Signature
NONCE	Nonce
NOTFY	Notification
DEL	Delete
VID	Vendor ID

23 Tools

This chapter explains how to upload new firmware, manage configuration files and restart your ZyXEL Device.

Do not interrupt the file transfer process as this may PERMANENTLY DAMAGE your ZyXEL Device.

23.1 Introduction

Use the instructions in this chapter to change the device's configuration file or upgrade its firmware. After you configure your device, you can backup the configuration file to a computer. That way if you later misconfigure the device, you can upload the backed up configuration file to return to your previous settings. You can alternately upload the factory default configuration file if you want to return the device to the original default settings. The firmware determines the device's available features and functionality. You can download new firmware releases from your nearest ZyXEL FTP site (or www.zyxel.com) to use to upgrade your device's performance.

Only use firmware for your device's specific model. Refer to the label on the bottom of your ZyXEL Device.

23.2 Filename Conventions

The configuration file (often called the romfile or rom-0) contains the factory default settings in the menus such as password, DHCP Setup, TCP/IP Setup, etc. It arrives from ZyXEL with a "rom" filename extension. Once you have customized the ZyXEL Device's settings, they can be saved back to your computer under a filename of your choosing.

ZyNOS (ZyXEL Network Operating System sometimes referred to as the “ras” file) is the system firmware and has a “bin” filename extension. Find this firmware at www.zyxel.com.With many FTP and TFTP clients, the filenames are similar to those seen next.

```
ftp> put firmware.bin ras
```

This is a sample FTP session showing the transfer of the computer file "firmware.bin" to the ZyXEL Device.

```
ftp> get rom-0 config.cfg
```

This is a sample FTP session saving the current configuration to the computer file “`config.cfg`”.

If your (T)FTP client does not allow you to have a destination filename different than the source, you will need to rename them as the ZyXEL Device only recognizes “rom-0” and “ras”. Be sure you keep unaltered copies of both files for later use.

The following table is a summary. Please note that the internal filename refers to the filename on the ZyXEL Device and the external filename refers to the filename not on the ZyXEL Device, that is, on your computer, local network or FTP site and so the name (but not the extension) may vary. After uploading new firmware, see the **Status** screen to confirm that you have uploaded the correct firmware version.

Table 139 Filename Conventions

FILE TYPE	INTERNAL NAME	EXTERNAL NAME	DESCRIPTION
Configuration File	Rom-0	This is the configuration filename on the ZyXEL Device. Uploading the rom-0 file replaces the entire ROM file system, including your ZyXEL Device configurations, system-related data (including the default password), the error log and the trace log.	*.rom
Firmware	Ras	This is the generic name for the ZyNOS firmware on the ZyXEL Device.	*.bin

23.3 File Maintenance Over WAN

TFTP, FTP and Telnet over the WAN will not work when:

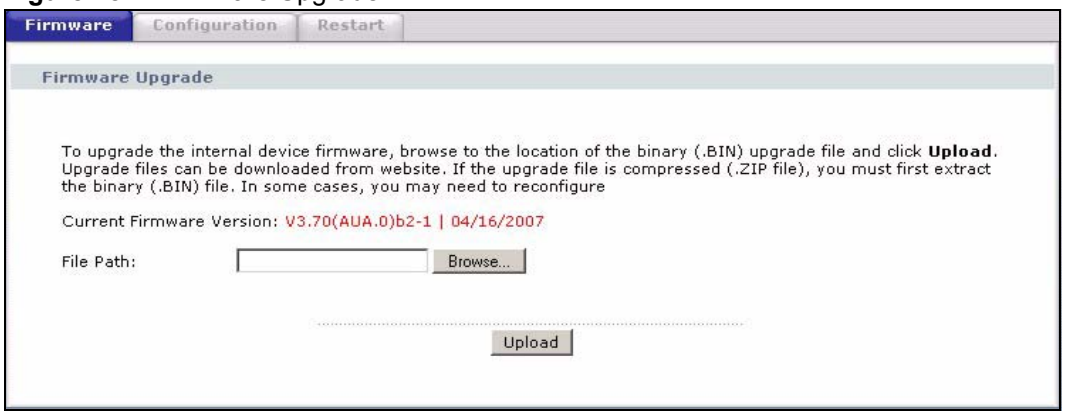
1. The firewall is active (turn the firewall off or create a firewall rule to allow access from the WAN).
2. You have disabled Telnet service in menu 24.11.
3. You have applied a filter in menu 3.1 (LAN) or in menu 11.5 (WAN) to block Telnet service.
4. The IP you entered in the **Secured Client IP** field in menu 24.11 does not match the client IP. If it does not match, the device will disconnect the Telnet session immediately.

23.4 Firmware Upgrade Screen

Click **Maintenance > Tools** to open the **Firmware** screen. Follow the instructions in this screen to upload firmware to your ZyXEL Device. The upload process uses HTTP (Hypertext Transfer Protocol) and may take up to two minutes. After a successful upload, the system will reboot. See Section 23.9 on page 312 for upgrading firmware using FTP/TFTP commands.

Do NOT turn off the ZyXEL Device while firmware upload is in progress!

Figure 182 Firmware Upgrade


Firmware
Configuration
Restart
Firmware Upgrade
To upgrade the internal device firmware, browse to the location of the binary (.BIN) upgrade file and click Upload. Upgrade files can be downloaded from website. If the upgrade file is compressed (.ZIP file), you must first extract the binary (.BIN) file. In some cases, you may need to reconfigure
Current Firmware Version: V3.70(AUA.0)b2-1 | 04/16/2007
File Path:
Browse...
Upload

The following table describes the labels in this screen.

Table 140 Firmware Upgrade

LABEL	DESCRIPTION
Current Firmware Version	This is the present Firmware version and the date created.
File Path	Type in the location of the file you want to upload in this field or click **Browse ...** to find it.
Browse...	Click **Browse...** to find the .bin file you want to upload. Remember that you must decompress compressed (.zip) files before you can upload them.
Upload	Click **Upload** to begin the upload process. This process may take up to two minutes.

After you see the **Firmware Upload in Progress** screen, wait two minutes before logging into the ZyXEL Device again.

Figure 183 Firmware Upload In Progress

ZyXEL
Firmware Upload In Progress
Do not Turn Off the Device.
Please Wait ...
Please wait for the device to finish restarting(PWR LED is on steady). This should take about two minutes.
To access the device after a successful firmware upload, you need to log in again. Check your new firmware version in the system status menu.

The ZyXEL Device automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 184 Network Temporarily Disconnected

After two minutes, log in again and check your new firmware version in the **Status** screen.

If the upload was not successful, the following screen will appear. Click **Return** to go back to the **Firmware** screen.

Figure 185 Error Message

System Upload
Firmware upload error!
The uploaded file was not accepted by the device. Please return to the previous page and select a valid upgrade file. Click Help for more information.
Return

23.5 Backup and Restore

See Section 23.7 on page 309 and Section 23.8 on page 312 for transferring configuration files using FTP/TFTP commands.

Click **Maintenance > Tools > Configuration**. Information related to factory defaults, backup configuration, and restoring configuration appears in this screen, as shown next.

Figure 186 Configuration

Firmware
Configuration
Restart
Backup Configuration
Click Backup to save the current configuration to you computer.
Backup
Restore Configuration
To restore a previously saved configuration file on your computer to the Prestige, please type a location for storing the configuration file or click Browse to look for one, and then click Upload.
File Path:
Browse...
Upload
Reset to Factory Default Settings
Click Reset to clear all user-entered configuration and return the Prestige to the factory default settings.
The following default settings would become effective after click Reset
Password :1234
Lan IP : 192.168.1.1
DHCP : Server .
Reset

23.5.1 Backup Configuration

Backup Configuration allows you to back up (save) the ZyXEL Device's current configuration to a file on your computer. Once your ZyXEL Device is configured and functioning properly, it is highly recommended that you back up your configuration file before making configuration changes. The backup configuration file will be useful in case you need to return to your previous settings.

Click **Backup** to save the ZyXEL Device's current configuration to your computer.

23.5.2 Restore Configuration

Restore Configuration allows you to upload a new or previously saved configuration file from your computer to your ZyXEL Device.

Table 141 Restore Configuration

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse ...** to find it.
Browse...	Click **Browse...** to find the file you want to upload. Remember that you must decompress compressed (.ZIP) files before you can upload them.
Upload	Click **Upload** to begin the upload process.

Do not turn off the ZyXEL Device while configuration file upload is in progress.

After you see a "restore configuration successful" screen, you must then wait one minute before logging into the ZyXEL Device again.

Figure 187 Configuration Upload Successful

ZyXEL
Restore Configuration successful
The Router Is Rebooting Now.
Please Wait ...
The router will now reboot.
As there will be no indication of when the process is complete, please wait for one minute before attempting to access the router again.

The ZyXEL Device automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

Figure 188 Network Temporarily Disconnected

If you uploaded the default configuration file you may need to change the IP address of your computer to be in the same subnet as that of the default device IP address (192.168.1.1). See Appendix A on page 337 for details on how to set up your computer's IP address.

If the upload was not successful, the following screen will appear. Click **Return** to go back to the **Configuration** screen.

Figure 189 Configuration Upload Error

System Restore
Restore configuration error!
The configuration file was not accepted by the device. Please return to the previous page and select a valid configuration file. Click Help for more information.
Return

23.5.3 Reset to Factory Defaults

Click the **Reset** button to clear all user-entered configuration information and return the ZyXEL Device to its factory defaults. The following warning screen appears.

Figure 190 Reset Warning Message

Microsoft Internet Explorer
Are you sure you want to reset the device back to the factory defaults?This will erase all of your custom configuration.
OK
Cancel

Figure 191 Reset In Process Message

ZyXEL
Reset to Factory Default Settings
Please Wait ...
The router will now reboot.
As there will be no indication of when the process is complete, please wait for one minute before attempting to access the device again.

You can also press the **RESET** button on the rear panel to reset the factory defaults of your ZyXEL Device. Refer to Section 1.6 on page 41 for more information on the **RESET** button.

23.6 Restart

System restart allows you to reboot the ZyXEL Device without turning the power off.

Click **Maintenance > Tools** > **Restart**. Click **Restart** to have the ZyXEL Device reboot. This does not affect the ZyXEL Device's configuration.

Figure 192 Restart Screen

Firmware
Configuration
Restart
System Reboot
Click Restart to have the device perform a software restart. The SYS(or PWR) LED blinks as the device restarts and then stays steady on if the restart is successful. Wait a minute before logging into the device again.
Restart

23.7 Using FTP or TFTP to Back Up Configuration

This section covers how to use FTP or TFTP to save your device's configuration file to your computer.

23.7.1 Using the FTP Commands to Back Up Configuration

1. Launch the FTP client on your computer.
2. Enter "`open`", followed by a space and the IP address of your ZyXEL Device.
3. Press [ENTER] when prompted for a username.
4. Enter your password as requested (the default is "1234").
5. Enter "`bin`" to set transfer mode to binary.
6. Use "`get`" to transfer files from the ZyXEL Device to the computer, for example, "`get rom-0 config.rom`" transfers the configuration file on the ZyXEL Device to your

computer and renames it "config.rom". See earlier in this chapter for more information on filename conventions.

7 Enter "quit" to exit the ftp prompt.

23.7.2 FTP Command Configuration Backup Example

This figure gives an example of using FTP commands from the DOS command prompt to save your device's configuration onto your computer.

Figure 193 FTP Session Example

```
331 Enter PASS command
Password:
230 Logged in
ftp> bin
200 Type I OK
ftp> get rom-0 zyxel.rom
200 Port command okay
150 Opening data connection for STOR ras
226 File received OK
ftp: 16384 bytes sent in 1.10Seconds 297.89Kbytes/sec.
ftp> quit
```

23.7.3 Configuration Backup Using GUI-based FTP Clients

The following table describes some of the commands that you may see in GUI-based FTP clients.

Table 142 General Commands for GUI-based FTP Clients

COMMAND	DESCRIPTION
Host Address	Enter the address of the host server.
Login Type	Anonymous. This is when a user I.D. and password is automatically supplied to the server for anonymous access. Anonymous logins will work only if your ISP or service administrator has enabled this option. Normal. The server requires a unique User ID and Password to login.
Transfer Type	Transfer files in either ASCII (plain text format) or in binary mode.
Initial Remote Directory	Specify the default remote directory (path).
Initial Local Directory	Specify the default local directory (path).

23.7.4 Backup Configuration Using TFTP

The ZyXEL Device supports the up/downloading of the firmware and the configuration file using TFTP (Trivial File Transfer Protocol) over LAN. Although TFTP should work over WAN as well, it is not recommended.

To use TFTP, your computer must have both telnet and TFTP clients. To backup the configuration file, follow the procedure shown next.

1. Use telnet from your computer to connect to the ZyXEL Device and log in. Because TFTP does not have any security checks, the ZyXEL Device records the IP address of the telnet client and accepts TFTP requests only from this address.
2. Enter command "`sys stdio 0`" to disable the management idle timeout, so the TFTP transfer will not be interrupted. Enter command "`sys stdio 5`" to restore the five-minute management idle timeout (default) when the file transfer is complete.
3. Launch the TFTP client on your computer and connect to the ZyXEL Device. Set the transfer mode to binary before starting data transfer.
4. Use the TFTP client (see the example below) to transfer files between the ZyXEL Device and the computer. The file name for the configuration file is "`rom-0`" (rom-zero, not capital o).

Note that the telnet connection must be active before and during the TFTP transfer. For details on TFTP commands (see following example), please consult the documentation of your TFTP client program. For UNIX, use "`get`" to transfer from the ZyXEL Device to the computer and "binary" to set binary transfer mode.

23.7.5 TFTP Command Configuration Backup Example

The following is an example TFTP command:

```
tftp [-i] host get rom-0 config.rom
```

where "`i`" specifies binary image transfer mode (use this mode when transferring binary files), "`host`" is the ZyXEL Device IP address, "`get`" transfers the file source on the ZyXEL Device (`rom-0`, name of the configuration file on the ZyXEL Device) to the file destination on the computer and renames it config.rom.

23.7.6 Configuration Backup Using GUI-based TFTP Clients

The following table describes some of the fields that you may see in GUI-based TFTP clients.

Table 143 General Commands for GUI-based TFTP Clients

COMMAND	DESCRIPTION
Host	Enter the IP address of the ZyXEL Device. 192.168.1.1 is the ZyXEL Device's default IP address when shipped.
Send/Fetch	Use "Send" to upload the file to the ZyXEL Device and "Fetch" to back up the file on your computer.
Local File	Enter the path and name of the firmware file (*.bin extension) or configuration file (*.rom extension) on your computer.
Remote File	This is the filename on the ZyXEL Device. The filename for the firmware is "ras" and for the configuration file, is "rom-0".
Binary	Transfer the file in binary mode.
Abort	Stop transfer of the file.

Refer to Section 23.3 on page 304 to read about configurations that disallow TFTP and FTP over WAN.

23.8 Using FTP or TFTP to Restore Configuration

This section shows you how to restore a previously saved configuration. Note that this function erases the current configuration before restoring a previous back up configuration; please do not attempt to restore unless you have a backup configuration file stored on disk.

FTP is the preferred method for restoring your current computer configuration to your device since FTP is faster. Please note that you must wait for the system to automatically restart after the file transfer is complete.

Do not interrupt the file transfer process as this may PERMANENTLY DAMAGE your device. When the Restore Configuration process is complete, the device automatically restarts.

23.8.1 Restore Using FTP Session Example

Figure 194 Restore Using FTP Session Example

```
ftp> put config.rom rom-0
200 Port command okay
150 Opening data connection for STOR rom-0
226 File received OK
221 Goodbye for writing flash
ftp: 16384 bytes sent in 0.06Seconds 273.07Kbytes/sec.
ftp>quit
```

Refer to Section 23.3 on page 304 to read about configurations that disallow TFTP and FTP over WAN.

23.9 FTP and TFTP Firmware and Configuration File Uploads

This section shows you how to upload firmware and configuration files.

Do not interrupt the file transfer process as this may PERMANENTLY DAMAGE your device.

FTP is the preferred method for uploading the firmware and configuration. To use this feature, your computer must have an FTP client. The following sections give examples of how to upload the firmware and the configuration files.

23.9.1 FTP File Upload Command from the DOS Prompt Example

1. Launch the FTP client on your computer.
2. Enter “open”, followed by a space and the IP address of your device.
3. Press [ENTER] when prompted for a username.
4. Enter your password as requested (the default is “1234”).
5. Enter “bin” to set transfer mode to binary.
6. Use “put” to transfer files from the computer to the device, for example, “put firmware.bin ras” transfers the firmware on your computer (firmware.bin) to the device and renames it “ras”. Similarly, “put config.rom rom-0” transfers the configuration file on your computer (config.rom) to the device and renames it “rom-0”. Likewise “get rom-0 config.rom” transfers the configuration file on the device to your computer and renames it “config.rom.” See earlier in this chapter for more information on filename conventions.
7. Enter “quit” to exit the ftp prompt.

23.9.2 FTP Session Example of Firmware File Upload

Figure 195 FTP Session Example of Firmware File Upload

```
331 Enter PASS command
Password:
230 Logged in
ftp> bin
200 Type I OK
ftp> put firmware.bin ras
200 Port command okay
150 Opening data connection for STOR ras
226 File received OK
ftp: 1103936 bytes sent in 1.10Seconds 297.89Kbytes/sec.
ftp> quit
```

More commands (found in GUI-based FTP clients) are listed earlier in this chapter.

Refer to Section 23.3 on page 304 to read about configurations that disallow TFTP and FTP over WAN.

23.9.3 TFTP File Upload

The device also supports the uploading of firmware files using TFTP (Trivial File Transfer Protocol) over LAN. Although TFTP should work over WAN as well, it is not recommended.

To use TFTP, your computer must have both telnet and TFTP clients. To transfer the firmware and the configuration file, follow the procedure shown next.

1. Use telnet from your computer to connect to the device and log in. Because TFTP does not have any security checks, the device records the IP address of the telnet client and accepts TFTP requests only from this address.

2. Enter the command “sys stdio 0” to disable the management idle timeout, so the TFTP transfer will not be interrupted. Enter “command sys stdio 5” to restore the five-minute management idle timeout (default) when the file transfer is complete.
3. Launch the TFTP client on your computer and connect to the device. Set the transfer mode to binary before starting data transfer.
4. Use the TFTP client (see the example below) to transfer files between the device and the computer. The file name for the firmware is “ras”.

Note that the telnet connection must be active and the device in CI mode before and during the TFTP transfer. For details on TFTP commands (see following example), please consult the documentation of your TFTP client program. For UNIX, use “get” to transfer from the device to the computer, “put” the other way around, and “binary” to set binary transfer mode.

23.9.4 TFTP Upload Command Example

The following is an example TFTP command:

```
tftp [-i] host put firmware.bin ras
```

Where “i” specifies binary image transfer mode (use this mode when transferring binary files), “host” is the device’s IP address, “put” transfers the file source on the computer (firmware.bin – name of the firmware on the computer) to the file destination on the remote host (ras - name of the firmware on the device).

Commands that you may see in GUI-based TFTP clients are listed earlier in this chapter.

24

Diagnostic

These read-only screens display information to help you identify problems with the ZyXEL Device.

24.1 General Diagnostic

Click **Maintenance > Diagnostic** to open the screen shown next.

Figure 196 Diagnostic: General

The following table describes the fields in this screen.

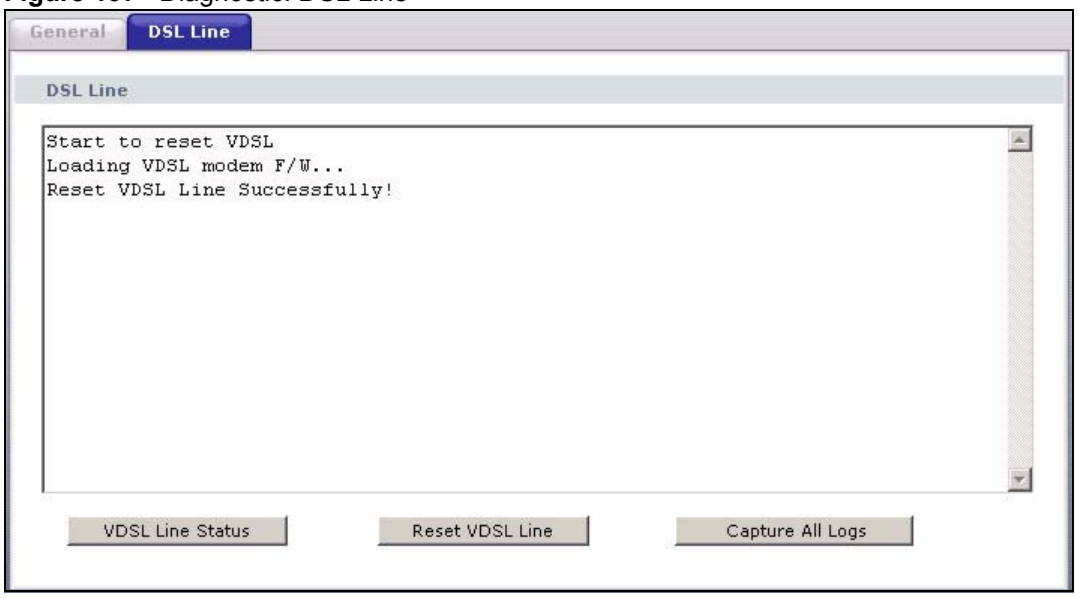
Table 144 Diagnostic: General

LABEL	DESCRIPTION
TCP/IP Address	Type the IP address of a computer that you want to ping in order to test a connection.
Ping	Click this button to ping the IP address that you entered.

24.2 DSL Line Diagnostic

Click **Maintenance > Diagnostic** > **DSL Line** to open the screen shown next.

Figure 197 Diagnostic: DSL Line



The following table describes the fields in this screen.

Table 145 Diagnostic: DSL Line

LABEL	DESCRIPTION
VDSL Line Status	Click this button to check the DSL connection status.
Reset VDSL Line	Click this button to reinitialize the VDSL line. The large text box above then displays the progress and results of this operation, for example: "Start to reset VDSL Loading VDSL modem F/W... Reset VDSL Line Successfully!"
Capture All Logs	Click this button to display information about your ZyXEL Device's DSL connection status, DHCP settings, firmware version, WAN and gateway IP address and LAN IP address.

25

Troubleshooting

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories.

- Power, Hardware Connections, and LEDs
- ZyXEL Device Access and Login
- Internet Access
- Phone Calls and VoIP

25.1 Power, Hardware Connections, and LEDs

The ZyXEL Device does not turn on. None of the LEDs turn on.

1. Make sure the ZyXEL Device is turned on.
2. Make sure you are using the power adaptor or cord included with the ZyXEL Device.
3. Make sure the power adaptor or cord is connected to the ZyXEL Device and plugged in to an appropriate power source. Make sure the power source is turned on.
4. Turn the ZyXEL Device off and on.
5. If the problem continues, contact the vendor.

One of the LEDs does not behave as expected.

1. Make sure you understand the normal behavior of the LED. See Section 1.5 on page 40.
2. Check the hardware connections. See the Quick Start Guide.
3. Inspect your cables for damage. Contact the vendor to replace any damaged cables.
4. Turn the ZyXEL Device off and on.
5. If the problem continues, contact the vendor.

25.2 ZyXEL Device Access and Login

I forgot the IP address for the ZyXEL Device.

1. The default IP address is **192.168.1.1**.
2. If you changed the IP address and have forgotten it, you might get the IP address of the ZyXEL Device by looking up the IP address of the default gateway for your computer. To do this in most Windows computers, click **Start > Run**, enter **cmd**, and then enter **ipconfig**. The IP address of the **Default Gateway** might be the IP address of the ZyXEL Device (it depends on the network), so enter this IP address in your Internet browser.
3. If this does not work, you have to reset the device to its factory defaults. See Section 1.6 on page 41.

I forgot the password.

1. The default password is **1234**.
2. If this does not work, you have to reset the device to its factory defaults. See Section 1.6 on page 41.

I cannot see or access the **Login** screen in the web configurator.

1. Make sure you are using the correct IP address.
   - The default IP address is 192.168.1.1.
   - If you changed the IP address (Section 7.3.1 on page 91), use the new IP address.
   - If you changed the IP address and have forgotten it, see the troubleshooting suggestions for I forgot the IP address for the ZyXEL Device.
2. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide.
3. Make sure your Internet browser does not block pop-up windows and has JavaScripts and Java enabled. See Appendix B on page 349.
4. If you disabled **Any IP** (Section 7.4.1 on page 95), make sure your computer is in the same subnet as the ZyXEL Device. (If you know that there are routers between your computer and the ZyXEL Device, skip this step.)
   - If there is a DHCP server on your network, make sure your computer is using a dynamic IP address. See Appendix A on page 337. Your ZyXEL Device is a DHCP server by default.
   - If there is no DHCP server on your network, make sure your computer's IP address is in the same subnet as the ZyXEL Device. See Appendix A on page 337.

5 Reset the device to its factory defaults, and try to access the ZyXEL Device with the default IP address. See Section 1.6 on page 41.
6 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestions

- Try to access the ZyXEL Device using another service, such as Telnet. If you can access the ZyXEL Device, check the remote management settings and firewall rules to find out why the ZyXEL Device does not respond to HTTP.
- If your computer is connected to the **WAN** port or is connected wirelessly, use a computer that is connected to a **LAN/ETHERNET** port.

I can see the **Login** screen, but I cannot log in to the ZyXEL Device.

1 Make sure you have entered the user name and password correctly. The default password is **1234**. These fields are case-sensitive, so make sure [Caps Lock] is not on.
2 You cannot log in to the web configurator while someone is using Telnet to access the ZyXEL Device. Log out of the ZyXEL Device in the other session, or ask the person who is logged in to log out.
3 Turn the ZyXEL Device off and on.
4 If this does not work, you have to reset the device to its factory defaults. See Section 25.1 on page 317.

I cannot Telnet to the ZyXEL Device.

See the troubleshooting suggestions for I cannot see or access the Login screen in the web configurator. Ignore the suggestions about your browser.

I cannot use FTP to upload / download the configuration file. / I cannot use FTP to upload new firmware.

See the troubleshooting suggestions for I cannot see or access the Login screen in the web configurator. Ignore the suggestions about your browser.

25.3 Internet Access

I cannot access the Internet.

1. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 1.5 on page 40.
2. Make sure you entered your ISP account information correctly in the wizard. These fields are case-sensitive, so make sure [Caps Lock] is not on.
3. If you are trying to access the Internet wirelessly, make sure the wireless settings in the wireless client are the same as the settings in the AP.
4. Disconnect all the cables from your device, and follow the directions in the Quick Start Guide again.
5. If the problem continues, contact your ISP.

I cannot access the Internet anymore. I had access to the Internet (with the ZyXEL Device), but my Internet connection is not available anymore.

1. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 1.5 on page 40.
2. Turn the ZyXEL Device off and on.
3. If the problem continues, contact your ISP.

The Internet connection is slow or intermittent.

1. There might be a lot of traffic on the network. Look at the LEDs, and check Section 1.5 on page 40. If the ZyXEL Device is sending or receiving a lot of information, try closing some programs that use the Internet, especially peer-to-peer applications.
2. Check the signal strength. If the signal strength is low, try moving the ZyXEL Device closer to the AP if possible, and look around to see if there are any devices that might be interfering with the wireless network (for example, microwaves, other wireless networks, and so on).
3. Turn the ZyXEL Device off and on.
4. If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

Advanced Suggestions

- Check the settings for bandwidth management. If it is disabled, you might consider activating it. If it is enabled, you might consider changing the allocations.

- Check the settings for QoS. If it is disabled, you might consider activating it. If it is enabled, you might consider raising or lowering the priority for some applications.

25.4 Phone Calls and VoIP

The telephone port won't work or the telephone lacks a dial tone.

Check the telephone connections and telephone wire.

Make sure you have the **VoIP SIP Settings** screen properly configured.

I can access the Internet, but cannot make VoIP calls.

Make sure you have the **VoIP SIP Settings** screen properly configured.

One of the **PHONE** lights should come on. Make sure that your telephone is connected to the corresponding **PHONE** port.

You can also check the VoIP status in the **Status** screen.

If the VoIP settings are correct, use speed dial to make peer-to-peer calls. If you can make a call using speed dial, there may be something wrong with the SIP server, contact your VoIP service provider.

I cannot call from one of the ZyXEL Device's phone ports to the other phone port.

You cannot call the SIP number of the SIP account that you are using to make a call. The ZyXEL Device generates a busy tone and does not attempt to establish a call if the SIP number you dial matches the outgoing SIP number of the phone port you are using.

For example, if you set **Phone 1** to use SIP account 1 and set **Phone 2** to use SIP account 2, then you can use **Phone 1** to call to SIP account 2's SIP number or **Phone 2** to call to SIP account 1's SIP number.

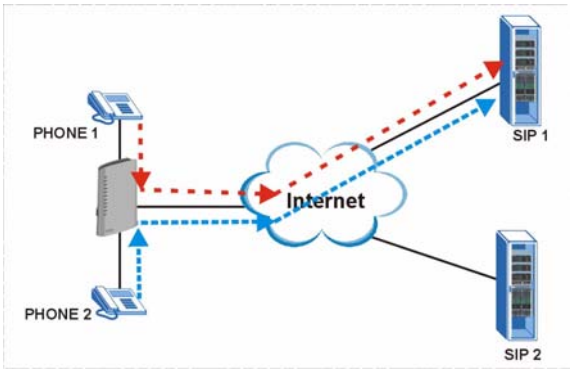
25.5 Problems With Multiple SIP Accounts

You can set up two SIP accounts on your ZyXEL Device and your ZyXEL Device is equipped with two phone ports. By default your ZyXEL Device uses SIP account 1 with both phone ports for outgoing calls, and it uses SIP accounts 1 and 2 for incoming calls. With this setting, you always use SIP account 1 for your outgoing calls and you cannot distinguish which SIP account the calls are coming in through. If you want to control the use of different dialing plans for accounting purposes or other reasons, you need to configure your phone ports in order to control which SIP account you are using when placing or receiving calls.

25.5.1 Outgoing Calls

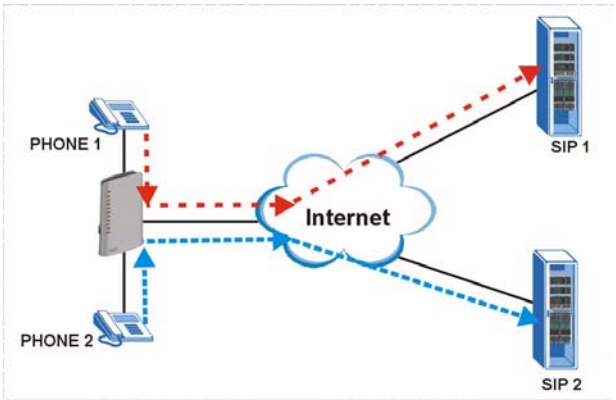
The following figure represents the default behavior of your ZyXEL Device when two SIP accounts are configured and you are using two phones. When you place a call from phone 1 or phone 2, the ZyXEL Device will use SIP account 1.

Figure 198 Outgoing Calls: Default



In the next example, phone port 1 is configured to use SIP account 1 and phone port 2 is configured to use SIP account 2. In this case, every time you place a call through phone port 1, you are using your SIP account 1. Similarly, every time you place a call through phone port 2, you are using your SIP account 2. To apply these configuration changes you need to configure the **Analog Phone** screen. See Section 10.8 on page 142.

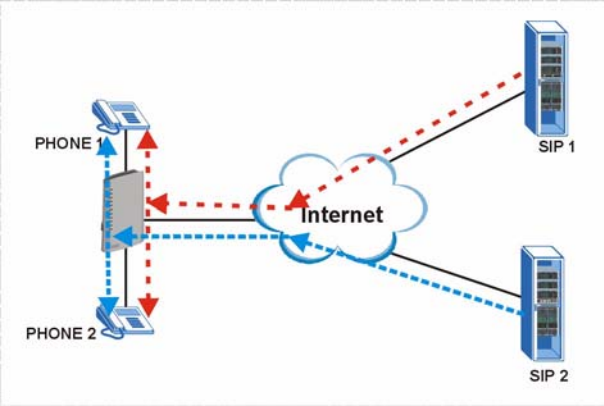
Figure 199 Outgoing Calls: Individual Configuration



25.5.2 Incoming Calls

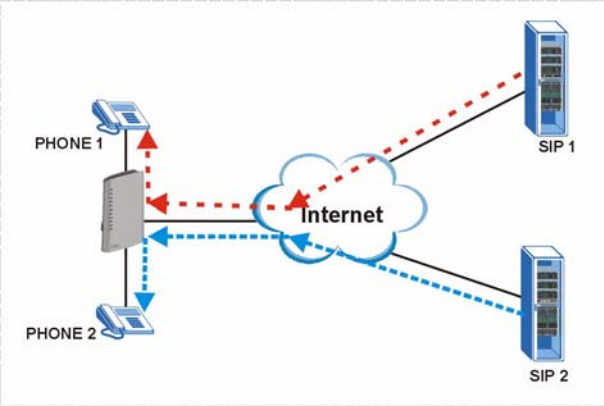
The following example shows the default behavior of your ZyXEL Device for incoming calls when two SIP accounts are configured and you are using two phones. When a call comes in from your SIP account 1, the phones connected to both phone port 1 and phone port 2 ring. Similarly, when a call comes in from your SIP account 2, the phones connected to both phone port 1 and phone port 2 ring. In either case you are not sure which SIP account the call is coming from.

Figure 200 Incoming Calls: Default



In the next example, phone port 1 is configured to use SIP account 1 and phone port 2 is configured to use SIP account 2 for incoming calls. In this case, every time you receive a call from your SIP account 1, the phone connected to phone port 1 rings. Similarly, every time you receive a call from your SIP account 2, the phone connected to phone port 2 rings. To apply these configuration changes you need to configure the **Analog Phone** screen. See Section 10.8 on page 142.

Figure 201 Incoming Calls: Individual Configuration



26

Product Specifications

This chapter gives details about your ZyXEL Device's hardware and firmware features.

Hardware Specifications

Table 146 Hardware Specifications

Dimensions	(168 W) x (37 D) x (248 H) mm
Weight	390g
Power Specification	18VAC 1A
Built-in Switch	Four auto-negotiating, auto MDI/MDI-X 10/100 Mbps RJ-45 Ethernet ports
PHONE Ports	2 RJ-11 FXS POTS ports.
PSTN Line port	1 RJ-11 FXS POTS port for making calls over the PSTN line.
RESET Button	Restores factory defaults
Antenna	One attached external dipole antenna, 2dBi
Operation Temperature	0º C ~ 40º C
Storage Temperature	-20º ~ 60º C
Operation Humidity	20% ~ 85% RH
Storage Humidity	20% ~ 90% RH

Firmware Specifications

Table 147 Firmware Specifications

Default IP Address	192.168.1.1
Default Subnet Mask	255.255.255.0 (24 bits)
Default Password	1234
DHCP Server IP Pool	192.168.1.32 to 192.168.1.64
Static DHCP Addresses	10
Content Filtering	Web page blocking by URL keyword.
Static Routes	16 IP
Device Management	Use the web configurator to easily configure the rich range of features on the ZyXEL Device.

Table 147 Firmware Specifications (continued)

Wireless Functionality (wireless devices only)	Allow the IEEE 802.11b and/or IEEE 802.11g wireless clients to connect to the ZyXEL Device wirelessly. Enable wireless security (WEP, WPA(2), WPA(2)-PSK) and/or MAC filtering to protect your wireless network.
Firmware Upgrade	Download new firmware (when available) from the ZyXEL web site and use the web configurator, an FTP or a TFTP tool to put it on the ZyXEL Device. Note: Only upload firmware for your specific model!
Configuration Backup & Restoration	Make a copy of the ZyXEL Device's configuration. You can put it back on the ZyXEL Device later if you decide to revert back to an earlier configuration.
Network Address Translation (NAT)	Each computer on your network must have its own unique IP address. Use NAT to convert your public IP address(es) to multiple private IP addresses for the computers on your network.
Port Forwarding	If you have a server (mail or web server for example) on your network, you can use this feature to let people access it from the Internet.
DHCP (Dynamic Host Configuration Protocol)	Use this feature to have the ZyXEL Device assign IP addresses, an IP default gateway and DNS servers to computers on your network.
Dynamic DNS Support	With Dynamic DNS (Domain Name System) support, you can use a fixed URL, www.zyxel.com for example, with a dynamic IP address. You must register for this service with a Dynamic DNS service provider.
IP Multicast	IP multicast is used to send traffic to a specific group of computers. The ZyXEL Device supports versions 1 and 2 of IGMP (Internet Group Management Protocol) used to join multicast groups (see RFC 2236).
Time and Date	Get the current time and date from an external server when you turn on your ZyXEL Device. You can also set the time manually. These dates and times are then used in logs.
Logs	Use logs for troubleshooting. You can send logs from the ZyXEL Device to an external syslog server.
Universal Plug and Play (UPnP)	A UPnP-enabled device can dynamically join a network, obtain an IP address and convey its capabilities to other devices on the network.
Firewall	You can configure firewall on the ZyXEL Device for secure Internet access. When the firewall is on, by default, all incoming traffic from the Internet to your network is blocked unless it is initiated from your network. This means that probes from the outside to your network are not allowed, but you can safely browse the Internet and download files for example.
Content Filter	The ZyXEL Device blocks or allows access to web sites that you specify and blocks access to web sites with URLs that contain keywords that you specify. You can define time periods and days during which content filtering is enabled. You can also include or exclude particular computers on your network from content filtering. You can also subscribe to category-based content filtering that allows your ZyXEL Device to check web sites against an external database.
QoS	You can efficiently manage traffic on your network by reserving bandwidth and giving priority to certain types of traffic and/or to particular computers.
Remote Management	This allows you to decide whether a service (HTTP or FTP traffic for example) from a computer on a network (LAN or WAN for example) can access the ZyXEL Device.
Any IP	The Any IP feature allows a computer to access the Internet and the ZyXEL Device without changing the network settings (such as IP address and subnet mask) of the computer, when the IP addresses of the computer and the ZyXEL Device are not in the same subnet.

Table 147 Firmware Specifications (continued)

Firewall	Your device has a stateful inspection firewall with DoS (Denial of Service) protection. By default, when the firewall is activated, all incoming traffic from the WAN to the LAN is blocked unless it is initiated from the LAN. The firewall supports TCP/UDP inspection, DoS detection and prevention, real time alerts, reports and logs.
IPSec VPN Capability	Establish a Virtual Private Network (VPN) to connect with business partners and branch offices using data encryption and the Internet to provide secure communications without the expense of leased site-to-site lines. The ZyXEL Device VPN is based on the IPSec standard and is interoperable with other IPSec-based VPN products. The ZyXEL Device supports up to two simultaneous IPSec connections.
Network Address Translation (NAT)	Network Address Translation (NAT) allows the translation of an Internet protocol address used within one network (for example a private IP address used in a local network) to a different IP address known within another network (for example a public IP address used on the Internet).
Content Filtering	Content filtering allows you to block access to Internet web sites that contain key words (that you specify) in the URL. You can also schedule when to perform the filtering and give trusted LAN IP addresses unfiltered Internet access.
Universal Plug and Play (UPnP)	Your device and other UPnP enabled devices can use the standard TCP/IP protocol to dynamically join a network, obtain an IP address and convey their capabilities to each other.
PPPoE Support (RFC2516)	PPPoE (Point-to-Point Protocol over Ethernet) emulates a dial-up connection. It allows your ISP to use their existing network configuration with newer broadband technologies such as ADSL. The PPPoE driver on your device is transparent to the computers on the LAN, which see only Ethernet and are not aware of PPPoE thus saving you from having to manage PPPoE clients on individual computers.
Dynamic DNS Support	With Dynamic DNS support, you can have a static hostname alias for a dynamic IP address, allowing the host to be more easily accessible from various locations on the Internet. You must register for this service with a Dynamic DNS service provider.
DHCP	DHCP (Dynamic Host Configuration Protocol) allows the individual clients (computers) to obtain the TCP/IP configuration at start-up from a centralized DHCP server. Your device has built-in DHCP server capability enabled by default. It can assign IP addresses, an IP default gateway and DNS servers to DHCP clients. Your device can also act as a surrogate DHCP server (DHCP Relay) where it relays IP address assignment from the actual real DHCP server to the clients.
IP Alias	IP alias allows you to partition a physical network into logical networks over the same Ethernet interface. Your device supports three logical LAN interfaces via its single physical Ethernet interface with the your device itself as the gateway for each LAN network.
Packet Filters	Your device's packet filtering function allows added network security and management.
VDSL2 Standards	ITU-T G.993.1 (VDSL) ITU-T G.993.2 (VDSL2)

Table 147 Firmware Specifications (continued)

Other Protocol Support	PPP (Point-to-Point Protocol) link layer protocol Transparent bridging for unsupported network layer protocols RIP I/RIP II ICMP ATM QoS SNMP v1 and v2c with MIB II support (RFC 1213) IP Multicasting IGMP v1 and v2 IGMP Proxy
Management	Embedded Web Configurator CLI (Command Line Interpreter) SNMP v1 & v2c with MIB II Embedded FTP/TFTP Server for firmware upgrade and configuration file backup and restore Telnet for remote management Remote Management Control: Telnet, FTP, Web, SNMP and DNS. VoIP Auto-provisioning via TFTP / HTTP Remote Firmware Upgrade Syslog
Other Features	Dynamic DNS SPTGEN QoS
Firewall	Stateful Packet Inspection Prevent Denial of Service attacks such as Ping of Death, SYN Flood, LAND, Smurf etc. Access Control of Service Content Filtering IP & Generic Packet Filtering Real time Attack Alerts and Logs Reports and logs SIP ALG passthrough
NAT/SUA	Port Forwarding 2048 NAT sessions Multimedia application PPTP under NAT/SUA IPSec passthrough SIP ALG passthrough
VPN	20 IPSec tunnels IKE and Manual Key Management AH and ESP Protocol DES, 3DES and AES Encryption SHA-1 and MD5 Authentication Tunnel and Transport Mode Encapsulation IPSec NAT Traversal NETBIOS pass-through for IPSec

Voice Specifications

To take full advantage of the supplementary phone services available through the ZyXEL Device's phone ports, you may need to subscribe to the services from your VoIP service provider.

Not all features are supported by all service providers. Consult your service provider for more information.

Table 148 Voice Features

Call Fallback	Call fallback allows you to set the ZyXEL Device to automatically use the PSTN connection for outgoing calls if the SIP account is not working, or to use the SIP account for outgoing calls if the PSTN port is unplugged or not working.
Call Park and Pickup	Call park and pickup lets you put a call on hold (park) and then continue the call (pickup). You can continue the call on the same phone, or another phone connected to the ZyXEL Device. The caller must still pay while the call is parked. When you park the call, you enter a number of your choice (up to eight digits), which you must enter again when you pick up the call. If you do not enter the correct number, you cannot pickup the call. This means that only someone who knows the number you have chosen can pick up the call. You can have more than one call on hold at the same time, but you must give each call a different number.
Country Code	Phone standards and settings differ from one country to another, so the settings on your ZyXEL Device must be configured to match those of the country you are in. The country code feature allows you to do this by selecting the country from a list rather than changing each setting manually. Configure the country code feature when you move the ZyXEL Device from one country to another.
Auto Dial	You can set the ZyXEL Device to automatically dial a specified number immediately whenever you lift a phone off the hook. Use the Web Configurator to set the specified number. Use the command line interpreter to have the ZyXEL Device wait a specified length of time before dialing the number.
Music on hold	This feature allows you to put a call on hold and have the other person hear a piece of audio (music, speech, etc.) you previously recorded.
Internal call	When you have phones attached to both of the ZyXEL Device's phone ports, you can dial "####" to place a call to the phone(s) connected to the other port.
Firmware update enable / disable	If your service provider uses this feature, you hear a recorded message when you pick up the phone when new firmware is available for your ZyXEL Device. Enter *99# in your phone's keypad to have the ZyXEL Device upgrade the firmware, or enter #99# to not upgrade. If your service provider gave you different numbers to use, enter them instead. If you enter the code to not upgrade, you can make a call as normal. You will hear the recording again each time you pick up the phone, until you upgrade.

Table 148 Voice Features

Call waiting	This feature allows you to hear an alert when you are already using the phone and another person calls you. You can then either reject the new incoming call, put your current call on hold and receive the new incoming call, or end the current call and receive the new incoming call.
Call forwarding	With this feature, you can set the ZyXEL Device to forward calls to a specified number, either unconditionally (always), when your number is busy, or when you do not answer. You can also forward incoming calls from one specified number to another.
Caller ID	The ZyXEL Device supports caller ID, which allows you to see the originating number of an incoming call (on a phone with a suitable display).
REN	A Ringer Equivalence Number (REN) is used to determine the number of devices (like telephones or fax machines) that may be connected to the telephone line. Your device has a REN of three, so it can support three devices per telephone port.
Dynamic Jitter Buffer	The built-in adaptive buffer helps to smooth out the variations in delay (jitter) for voice traffic. This helps ensure good voice quality for your conversations.
Multiple SIP Accounts	You can simultaneously use multiple voice (SIP) accounts and assign them to one or both telephone ports.
Multiple Voice Channels	Your device can simultaneously handle multiple voice channels (telephone calls). Additionally you can answer an incoming phone call on a VoIP account, even while someone else is using the account for a phone call.
Voice Activity Detection/Silence Suppression	Voice Activity Detection (VAD) reduces the bandwidth that a call uses by not transmitting when you are not speaking.
Comfort Noise Generation	Your device generates background noise to fill moments of silence when the other device in a call stops transmitting because the other party is not speaking (as total silence could easily be mistaken for a lost connection).
Echo Cancellation	You device supports G.168, an ITU-T standard for eliminating the echo caused by the sound of your voice reverberating in the telephone receiver while you talk.
QoS (Quality of Service)	Quality of Service (QoS) mechanisms help to provide better service on a per-flow basis. Your device supports Type of Service (ToS) tagging and Differentiated Services (DiffServ) tagging. This allows the device to tag voice frames so they can be prioritized over the network.
SIP ALG	Your device is a SIP Application Layer Gateway (ALG). It allows VoIP calls to pass through NAT for devices behind it (such as a SIP-based VoIP software application on a computer).
Other Voice Features	SIP version 2 (Session Initiating Protocol RFC 3261) SDP (Session Description Protocol RFC 2327) RTP (RFC 1889) RTCP (RFC 1890) Voice codecs (coder/decoders) G.711, G.726, G.729 Fax and data modem discrimination DTMF Detection and Generation DTMF: In-band and Out-band traffic (RFC 2833),(PCM), (SIP INFO) Point-to-point call establishment between two IADs Quick dialing through predefined phone book, which maps the phone dialing number and destination URL. Flexible Dial Plan (RFC3525 section 7.1.14)

Wireless Features

Table 149 Wireless Features

External Antenna	The ZyXEL Device is equipped with an attached antenna to provide a clear radio signal between the wireless stations and the access points.
Wireless LAN MAC Address Filtering	Your device can check the MAC addresses of wireless stations against a list of allowed or denied MAC addresses.
WEP Encryption	WEP (Wired Equivalent Privacy) encrypts data frames before transmitting over the wireless network to help keep network communications private.
Wi-Fi Protected Access	Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i security standard. Key differences between WPA and WEP are user authentication and improved data encryption.
WPA2	WPA 2 is a wireless security standard that defines stronger encryption, authentication and key management than WPA.
Other Wireless Features	IEEE 802.11g Compliance Frequency Range: 2.4 GHz ISM Band Advanced Orthogonal Frequency Division Multiplexing (OFDM) Data Rates: 54Mbps, 11Mbps, 5.5Mbps, 2Mbps, and 1 Mbps Auto Fallback Turn on-off WLAN by reset button (press 1s on reset button to turn on or turn off the WLAN; 3s for OTIST; 10s to reset back to factory default) WPA2 IEEE 802.11i IEEE 802.11e Wired Equivalent Privacy (WEP) Data Encryption 64/128/256 bit. WLAN bridge to LAN Up to 32 MAC Address filters IEEE 802.1x Store up to 32 built-in user profiles using EAP-MD5 (Local User Database) External RADIUS server using EAP-MD5, TLS, TTLS OTIST (ZyXEL's One-Touch Intelligent Security Technology)

IEEE 802.11g Wireless LAN

IEEE 802.11g is fully compatible with the IEEE 802.11b standard. This means an IEEE 802.11b radio card can interface directly with an IEEE 802.11g access point (and vice versa) at 11 Mbps or lower depending on range. IEEE 802.11g has several intermediate rate steps between the maximum and minimum data rates. The IEEE 802.11g data rate and modulation are as follows:

Table 150 IEEE 802.11g

DATA RATE (MBPS)	MODULATION
1	DBPSK (Differential Binary Phase Shift Keyed)
2	DQPSK (Differential Quadrature Phase Shift Keying)
5.5 / 11	CCK (Complementary Code Keying)
6/9/12/18/24/36/48/54	OFDM (Orthogonal Frequency Division Multiplexing)

Your device may be prone to RF (Radio Frequency) interference from other 2.4 GHz devices such as microwave ovens, wireless phones, Bluetooth enabled devices, and other wireless LANs.

Standards Supported

The following list, which is not exhaustive, illustrates the standards supported in the ZyXEL Device.

Table 151 Standards Supported

STANDARD	DESCRIPTION
RFC 867	Daytime Protocol
RFC 868	Time Protocol.
RFC 1058	RIP-1 (Routing Information Protocol)
RFC 1112	IGMP v1
RFC 1157	SNMPv1: Simple Network Management Protocol version 1
RFC 1305	Network Time Protocol (NTP version 3)
RFC 1441	SNMPv2 Simple Network Management Protocol version 2
RFC 1631	IP Network Address Translator (NAT)
RFC 1661	The Point-to-Point Protocol (PPP)
RFC 1723	RIP-2 (Routing Information Protocol)
RFC 1901	SNMPv2c Simple Network Management Protocol version 2c
RFC 2236	Internet Group Management Protocol, Version 2.
RFC 2408	Internet Security Association and Key Management Protocol (ISAKMP)
RFC 2516	A Method for Transmitting PPP Over Ethernet (PPPoE)
RFC 2766	Network Address Translation - Protocol
IEEE 802.11	Also known by the brand Wi-Fi, denotes a set of Wireless LAN/WLAN standards developed by working group 11 of the IEEE LAN/MAN Standards Committee (IEEE 802).
IEEE 802.11b	Uses the 2.4 gigahertz (GHz) band
IEEE 802.11g	Uses the 2.4 gigahertz (GHz) band
IEEE 802.11d	Standard for Local and Metropolitan Area Networks: Media Access Control (MAC) Bridges
IEEE 802.11x	Port Based Network Access Control.
IEEE 802.11e QoS	IEEE 802.11 e Wireless LAN for Quality of Service
ITU-T G.993.1 (VDSL)	ITU standard that defines VDSL.
ITU-T G.993.2 (VDSL2)	ITU standard that defines VDSL2.
TR-069	TR-069 DSL Forum Standard for CPE Wan Management.

Power Adaptor Specifications

Table 152 P-2802HWL-I Series Power Adaptor Specifications

North American PLUG standards	LEI (LEADER ELECTRONICS INC.)
AC Power Adapter Model	MU18-2180100-A1
Input Power	AC 100~240Volts/50/60Hz/0.6A
Output Power	DC 18Volts/1A
Power Consumption	12 Watt max
Safety Standards	UL,CUL(UL 60950-1)
EUROPEAN PLUG STANDARDS	
AC Power Adapter Model	MU18-2180100-C5
Input Power	AC 100~240Volts/50/60Hz/0.6A
Output Power	DC 18Volts/1A
Power Consumption	12 Watt max
Safety Standards	TUV, CE(EN 60950-1)
UNITED KINGDOM PLUG STANDARDS	
AC Power Adapter Model	MU18-2180100-B2
Input Power	AC 100~240Volts/50/60Hz/0.6A
Output Power	DC 18Volts/1A
Power Consumption	12 Watt max
Safety Standards	TUV, CE(EN 60950-1)

PART V Appendices and Index

The appendices provide general information. Some details may not apply to your ZyXEL Device.

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Pop-up Windows, JavaScripts and Java Permissions (349)

IP Addresses and Subnetting (355)

Wireless LANs (363)

Services (373)

Command Interpreter (1)

Internal SPTGEN (377)

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A

Setting up Your Computer's IP Address

All computers must have a 10M or 100M Ethernet adapter card and TCP/IP installed.

Windows 95/98/Me/NT/2000/XP, Macintosh OS 7 and later operating systems and all versions of UNIX/LINUX include the software components you need to install and use TCP/IP on your computer. Windows 3.1 requires the purchase of a third-party TCP/IP application package.

TCP/IP should already be installed on computers using Windows NT/2000/XP, Macintosh OS 7 and later operating systems.

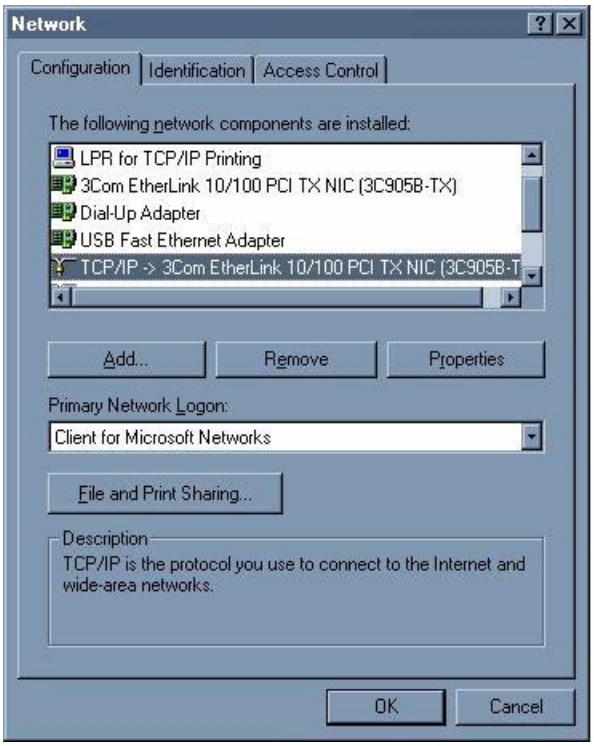
After the appropriate TCP/IP components are installed, configure the TCP/IP settings in order to "communicate" with your network.

If you manually assign IP information instead of using dynamic assignment, make sure that your computers have IP addresses that place them in the same subnet as the ZyXEL Device's LAN port.

Windows 95/98/Me

Click **Start**, **Settings**, **Control Panel** and double-click the **Network** icon to open the **Network** window

Figure 202 WIndows 95/98/Me: Network: Configuration



Installing Components

The **Network** window **Configuration** tab displays a list of installed components. You need a network adapter, the TCP/IP protocol and Client for Microsoft Networks.

If you need the adapter:

1. In the **Network** window, click **Add**.
2. Select **Adapter** and then click **Add**.
3. Select the manufacturer and model of your network adapter and then click **OK**.

If you need TCP/IP:

1. In the **Network** window, click **Add**.
2. Select **Protocol** and then click **Add**.
3. Select **Microsoft** from the list of **manufacturers**.
4. Select **TCP/IP** from the list of network protocols and then click **OK**.

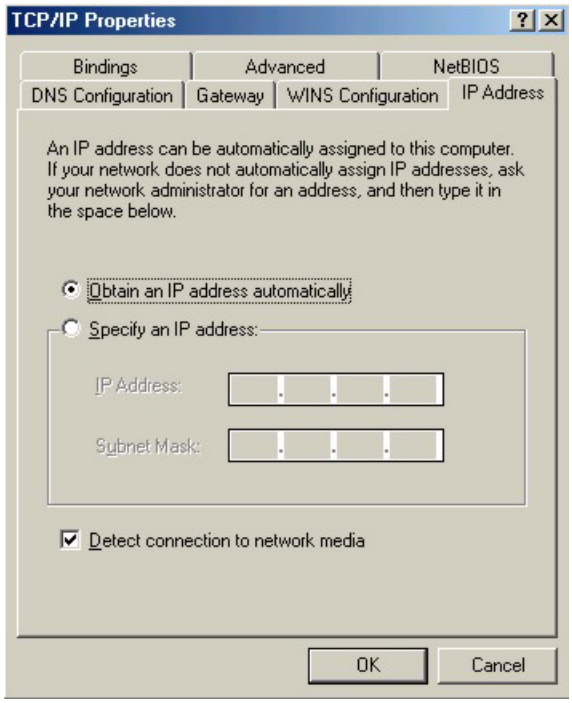
If you need Client for Microsoft Networks:

1. Click **Add**.
2. Select **Client** and then click **Add**.
3. Select **Microsoft** from the list of manufacturers.
4. Select **Client for Microsoft Networks** from the list of network clients and then click **OK**.
5. Restart your computer so the changes you made take effect.

Configuring

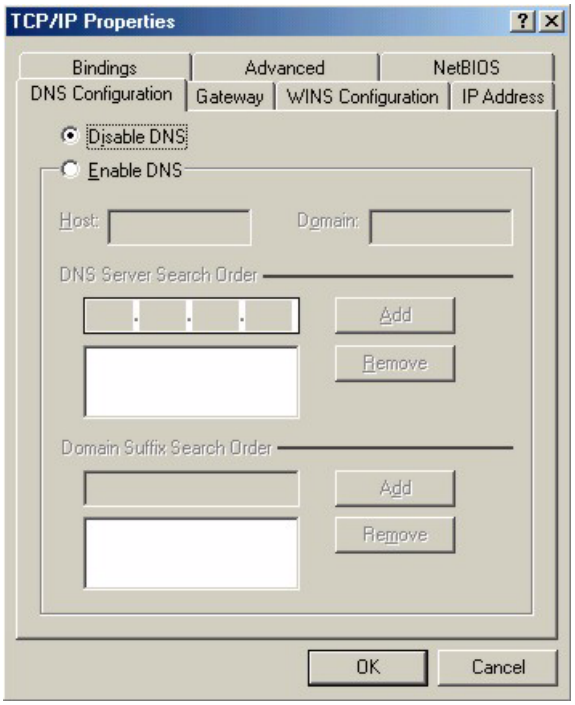
1. In the **Network** window **Configuration** tab, select your network adapter's TCP/IP entry and click **Properties**
2. Click the **IP Address** tab.
   - If your IP address is dynamic, select **Obtain an IP address automatically**.
   - If you have a static IP address, select **Specify an IP address** and type your information into the **IP Address** and **Subnet Mask** fields.

Figure 203 Windows 95/98/Me: TCP/IP Properties: IP Address


TCP/IP Properties
Bindings
Advanced
NetBIOS
DNS Configuration
Gateway
WINS Configuration
IP Address
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.
Obtain an IP address automatically
Specify an IP address:
IP Address:
Subnet Mask:
Detect connection to network media
OK
Cancel

3. Click the **DNS** Configuration tab.
   - If you do not know your DNS information, select **Disable DNS**.
   - If you know your DNS information, select **Enable DNS** and type the information in the fields below (you may not need to fill them all in).

Figure 204 Windows 95/98/Me: TCP/IP Properties: DNS Configuration



4 Click the **Gateway** tab.
   - If you do not know your gateway's IP address, remove previously installed gateways.
   - If you have a gateway IP address, type it in the **New gateway field** and click **Add**.
5 Click **OK** to save and close the **TCP/IP Properties** window.
6 Click **OK** to close the **Network** window. Insert the Windows CD if prompted.
7 Turn on your ZyXEL Device and restart your computer when prompted.

Verifying Settings

1 Click **Start** and then **Run**.
2 In the **Run** window, type "winipcfg" and then click **OK** to open the **IP Configuration** window.
3 Select your network adapter. You should see your computer's IP address, subnet mask and default gateway.

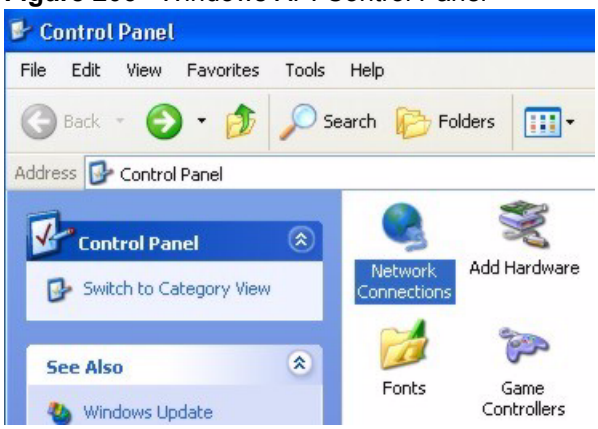
Windows 2000/NT/XP

1 For Windows XP, click **start**, **Control Panel**. In Windows 2000/NT, click **Start**, **Settings**, **Control Panel**.

Figure 205 Windows XP: Start Menu

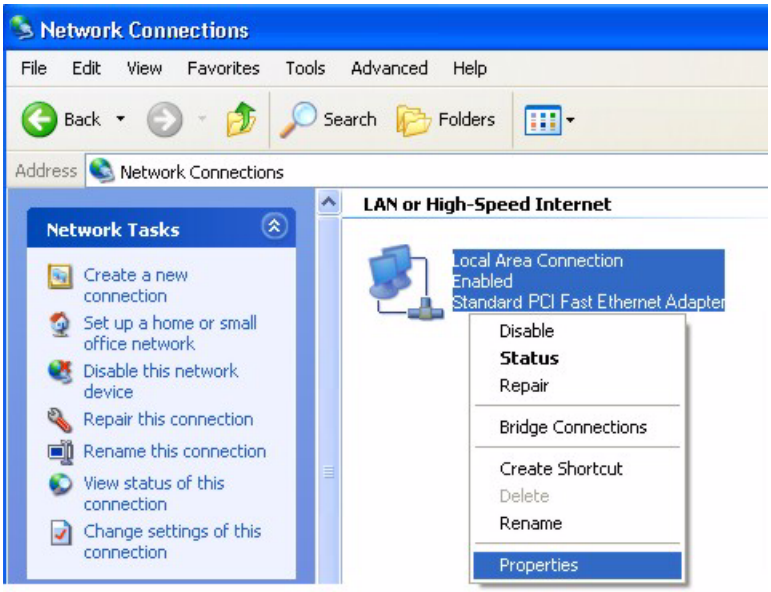
2 For Windows XP, click **Network Connections**. For Windows 2000/NT, click **Network and Dial-up Connections**.

Figure 206 Windows XP: Control Panel



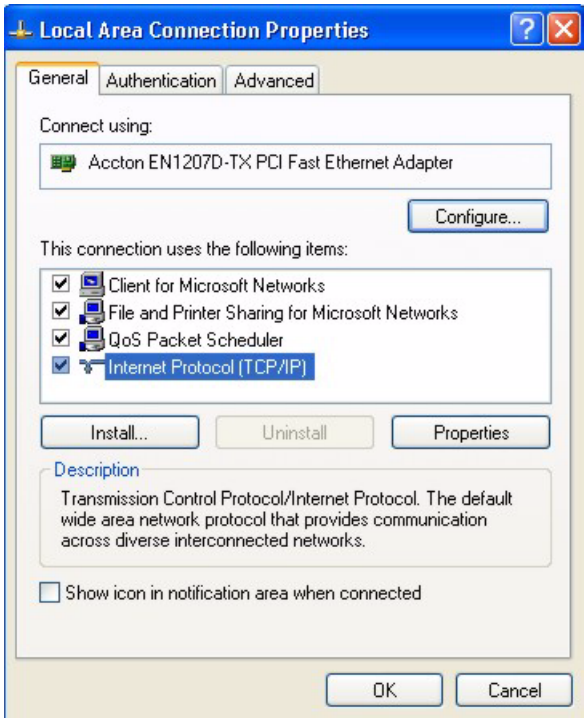
3 Right-click **Local Area Connection** and then click **Properties**.

Figure 207 Windows XP: Control Panel: Network Connections: Properties



4 Select **Internet Protocol (TCP/IP)** (under the **General** tab in Win XP) and click **Properties**.

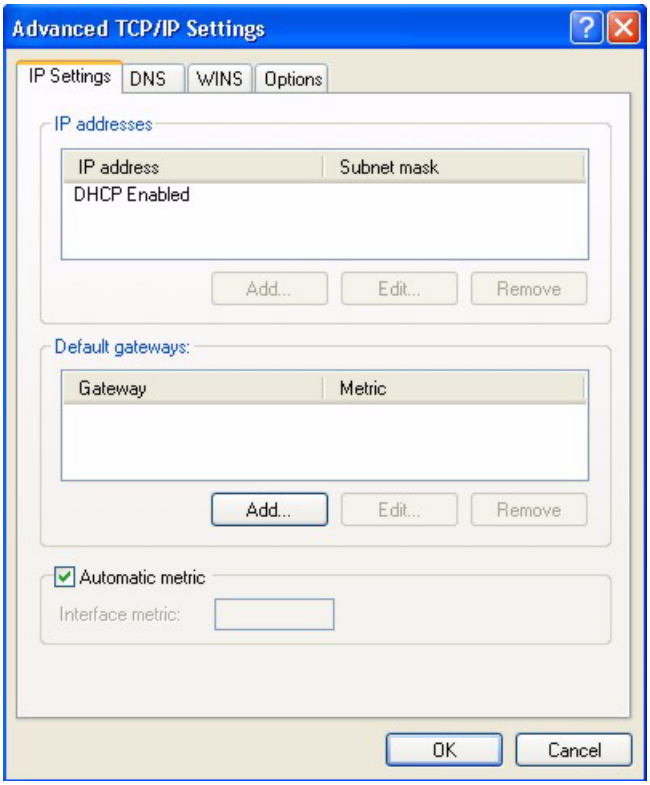
Figure 208 Windows XP: Local Area Connection Properties


Local Area Connection Properties
General Authentication Advanced
Connect using:
Accton EN1207D-TX PCI Fast Ethernet Adapter
Configure...
This connection uses the following items:
Client for Microsoft Networks
File and Printer Sharing for Microsoft Networks
QoS Packet Scheduler
Internet Protocol (TCP/IP)
Install... Uninstall Properties
Description
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.
Show icon in notification area when connected
OK Cancel

5 The **Internet Protocol TCP/IP Properties** window opens (the **General tab** in Windows XP).

- If you have a dynamic IP address click **Obtain an IP address automatically**.
- If you have a static IP address click **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields. Click **Advanced**.

Figure 209 Windows XP: Advanced TCP/IP Settings



6 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Setting**s tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

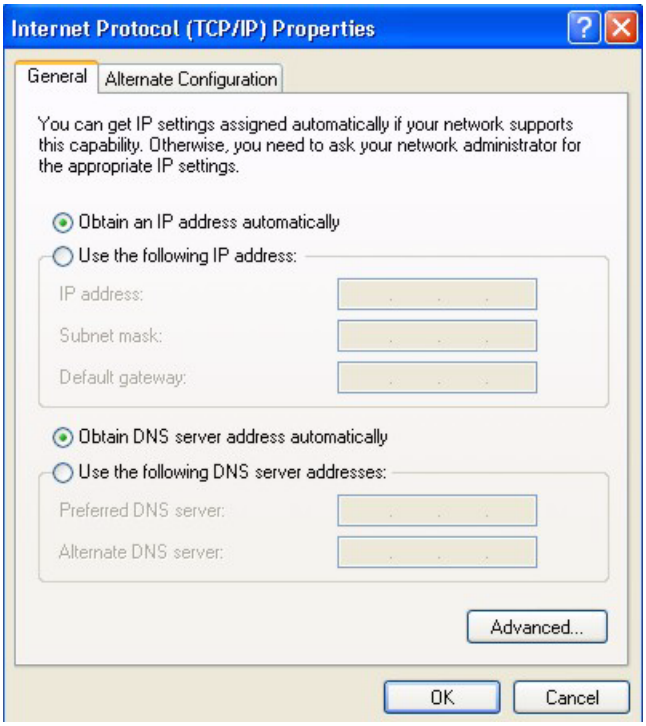
- In the **IP Settings** tab, in IP addresses, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

7 In the **Internet Protocol TCP/IP Properties** window (the **General tab** in Windows XP):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 210 Windows XP: Internet Protocol (TCP/IP) Properties


Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

8 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

9 Click **OK** to close the **Local Area Connection Properties** window.

10 Turn on your ZyXEL Device and restart your computer (if prompted).

Verifying Settings

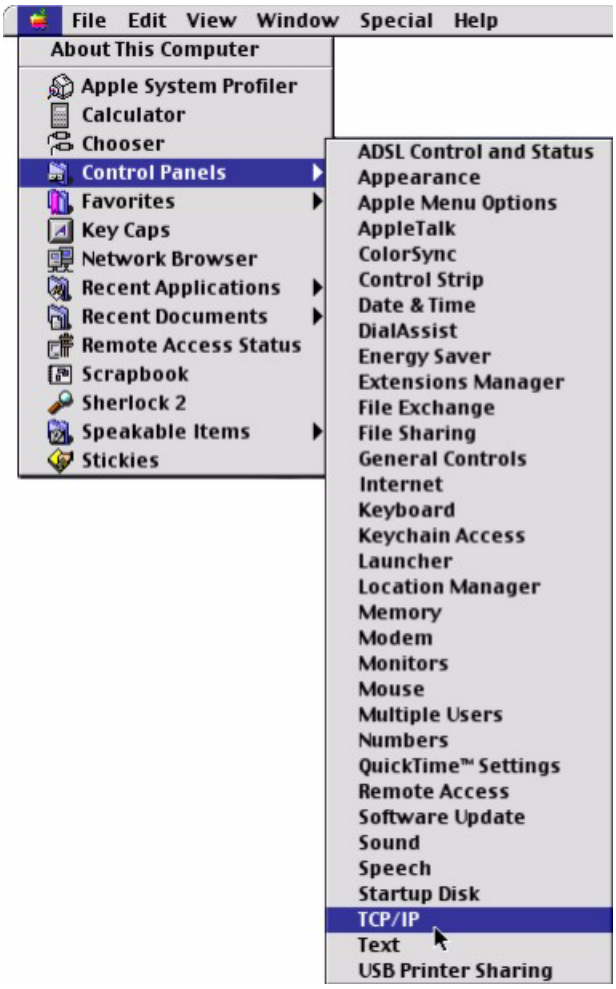
1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

2 In the **Command Prompt** window, type "`ipconfig`" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

Macintosh OS 8/9

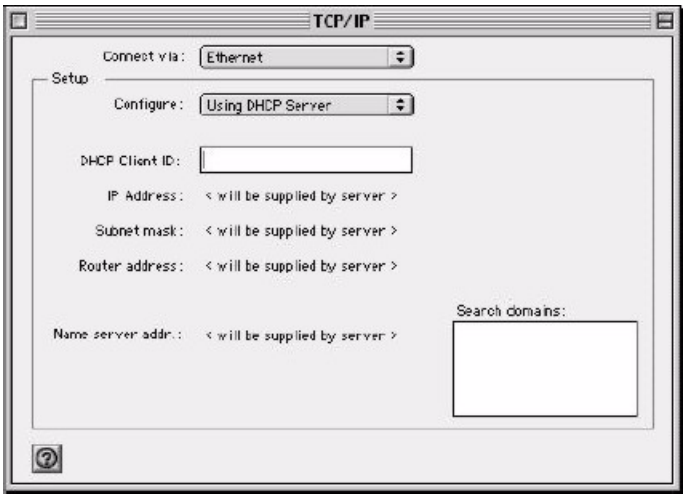
1 Click the **Apple** menu, **Control Panel** and double-click **TCP/IP** to open the **TCP/IP Control Panel**.

Figure 211 Macintosh OS 8/9: Apple Menu



2 Select **Ethernet built-in** from the **Connect via** list.

Figure 212 Macintosh OS 8/9: TCP/IP



3 For dynamically assigned settings, select **Using DHCP Server** from the **Configure:** list.

4 For statically assigned settings, do the following:
   - From the **Configure** box, select **Manually**.
   - Type your IP address in the **IP Address** box.
   - Type your subnet mask in the **Subnet mask** box.
   - Type the IP address of your ZyXEL Device in the **Router address** box.
5 Close the **TCP/IP Control Panel**.
6 Click **Save** if prompted, to save changes to your configuration.
7 Turn on your ZyXEL Device and restart your computer (if prompted).

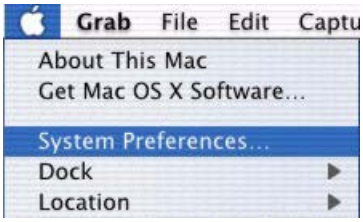
Verifying Settings

Check your TCP/IP properties in the **TCP/IP Control Panel** window.

Macintosh OS X

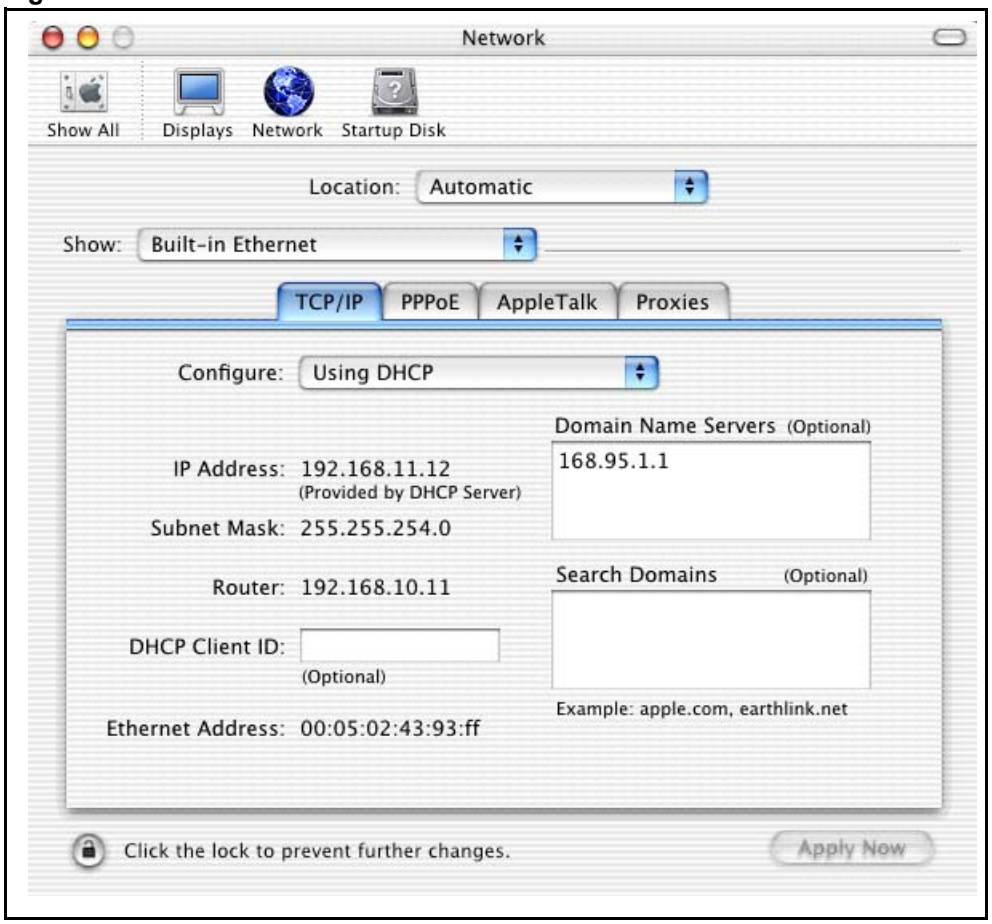
1 Click the **Apple** menu, and click **System Preferences** to open the **System Preferences** window.

Figure 213 Macintosh OS X: Apple Menu



2 Click **Network** in the icon bar.
   - Select **Automatic** from the **Location** list.
   - Select **Built-in Ethernet** from the **Show** list.
   - Click the **TCP/IP** tab.
3 For dynamically assigned settings, select **Using DHCP** from the **Configure** list.

Figure 214 Macintosh OS X: Network



4 For statically assigned settings, do the following:
   - From the **Configure** box, select **Manually**.
   - Type your IP address in the **IP Address** box.
   - Type your subnet mask in the **Subnet mask** box.
   - Type the IP address of your ZyXEL Device in the **Router address** box.
5 Click **Apply Now** and close the window.
6 Turn on your ZyXEL Device and restart your computer (if prompted).

Verifying Settings

Check your TCP/IP properties in the **Network** window.

B

Pop-up Windows, JavaScripts and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

Internet Explorer Pop-up Blockers

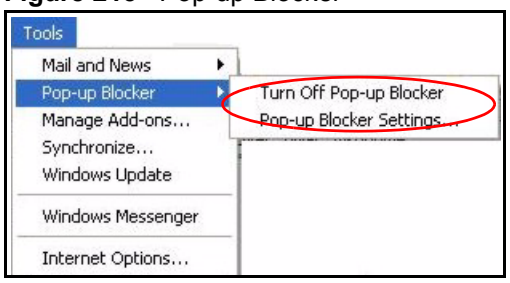
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

Disable pop-up Blockers

1 In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

Figure 215 Pop-up Blocker

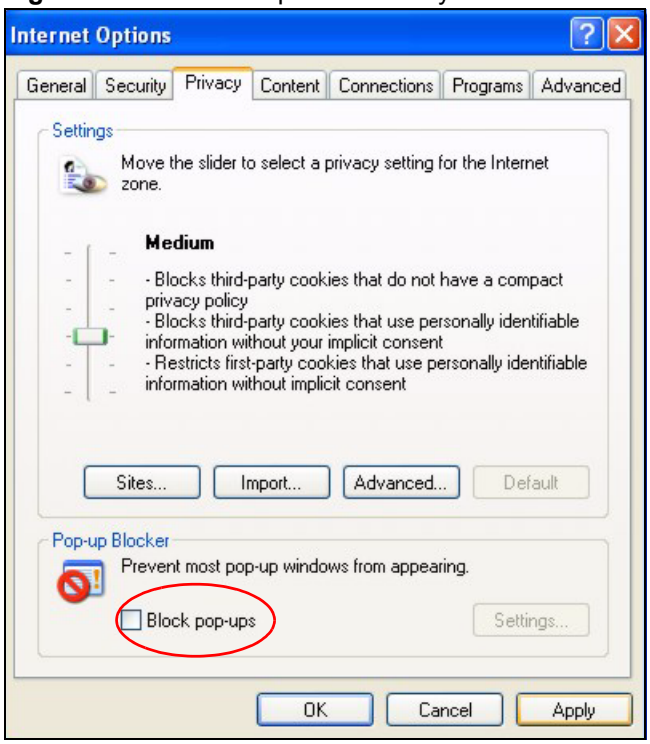


You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1 In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.

2 Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

Figure 216 Internet Options: Privacy



3 Click **Apply** to save this setting.

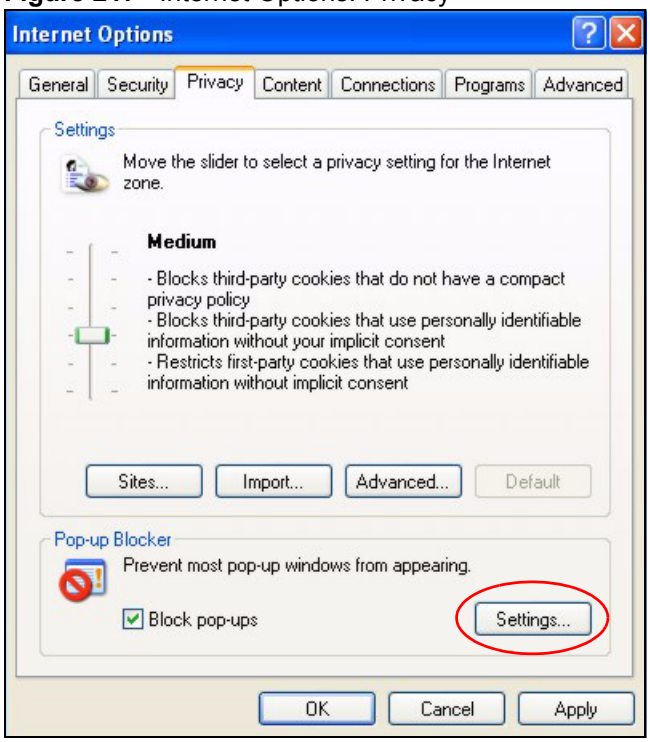
Enable pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

1 In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.

2 Select **Settings…**to open the **Pop-up Blocker Settings** screen.

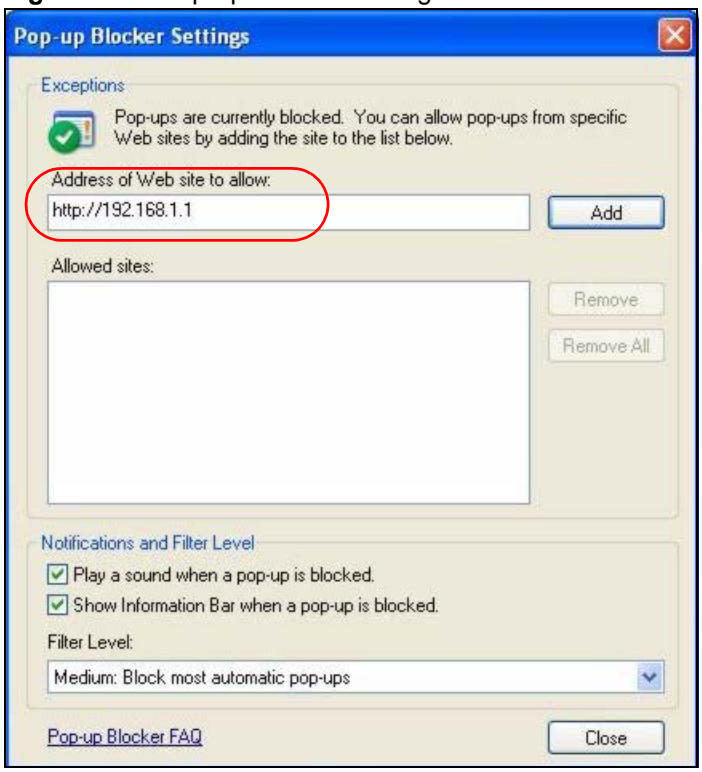
Figure 217 Internet Options: Privacy



3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix "http://". For example, http://192.168.167.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

Figure 218 Pop-up Blocker Settings


Pop-up Blocker Settings
Exceptions
Pop-ups are currently blocked. You can allow pop-ups from specific Web sites by adding the site to the list below.
Address of Web site to allow:
http://192.168.1.1
Add
Allowed sites:
Remove
Remove All
Notifications and Filter Level
Play a sound when a pop-up is blocked.
Show Information Bar when a pop-up is blocked.
Filter Level:
Medium: Block most automatic pop-ups
Pop-up Blocker FAQ
Close

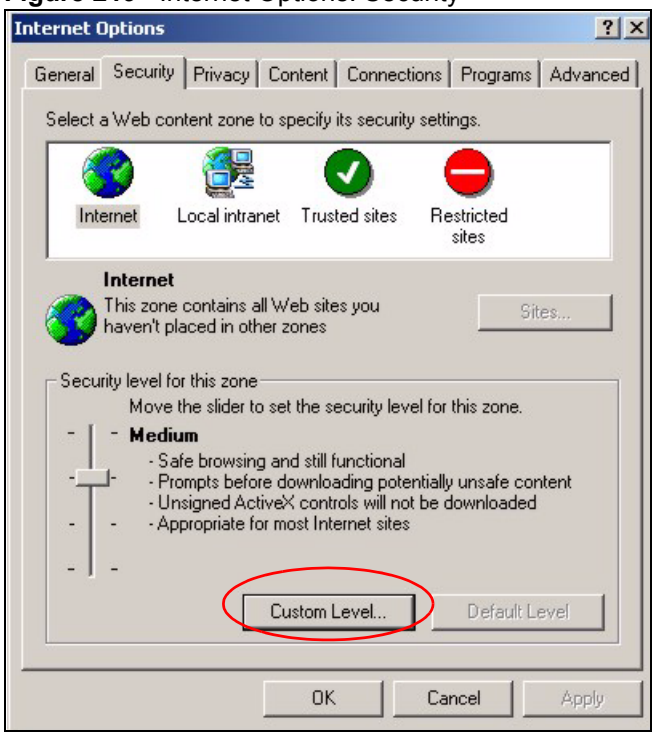
5 Click **Close** to return to the **Privacy** screen.
6 Click **Apply** to save this setting.

JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

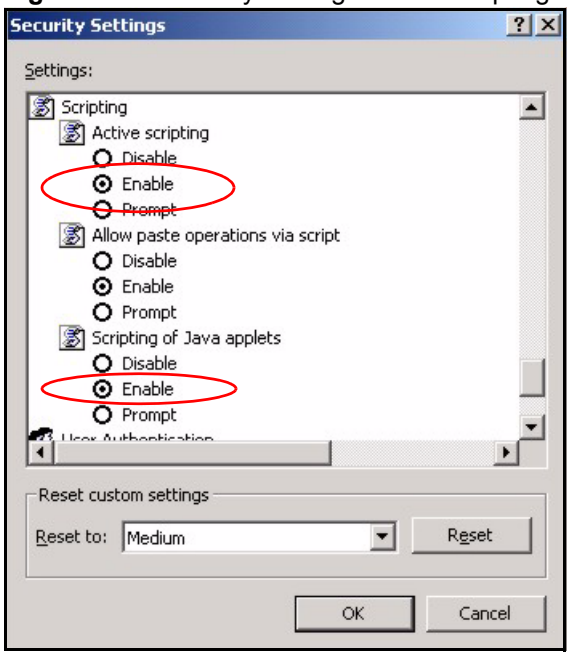
1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 219 Internet Options: Security



2 Click the **Custom Level...** button.
3 Scroll down to **Scripting**.
4 Under **Active scripting** make sure that **Enable** is selected (the default).
5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).
6 Click **OK** to close the window.

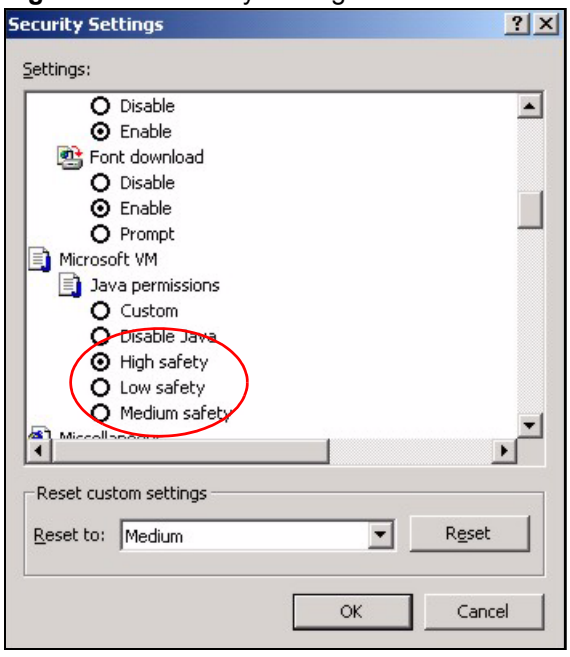
Figure 220 Security Settings - Java Scripting



Java Permissions

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.
2. Click the **Custom Level...** button.
3. Scroll down to **Microsoft VM**.
4. Under **Java permissions** make sure that a safety level is selected.
5. Click **OK** to close the window.

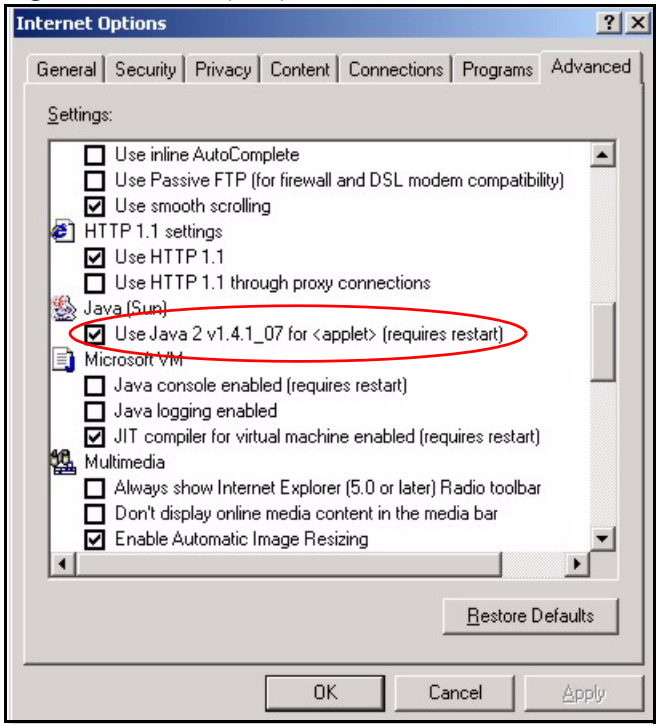
Figure 221 Security Settings - Java



JAVA (Sun)

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.
2 Make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.
3 Click **OK** to close the window.

Figure 222 Java (Sun)



C

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

Introduction to IP Addresses

One part of the IP address is the network number, and the other part is the host ID. In the same way that houses on a street share a common street name, the hosts on a network share a common network number. Similarly, as each house has its own house number, each host on the network has its own unique identifying number - the host ID. Routers use the network number to send packets to the correct network, while the host ID determines to which host on the network the packets are delivered.

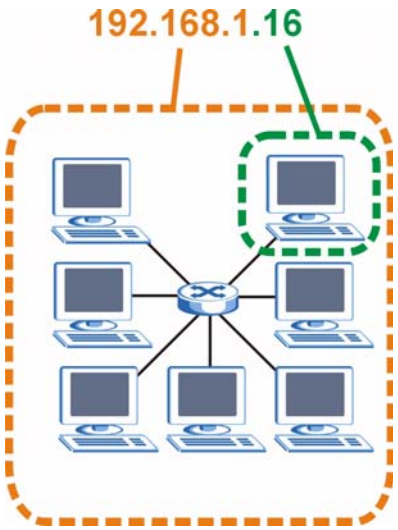
Structure

An IP address is made up of four parts, written in dotted decimal notation (for example, 192.168.1.1). Each of these four parts is known as an octet. An octet is an eight-digit binary number (for example 11000000, which is 192 in decimal notation).

Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.

The following figure shows an example IP address in which the first three octets (192.168.1) are the network number, and the fourth octet (16) is the host ID.

Figure 223 Network Number and Host ID



How much of the IP address is the network number and how much is the host ID varies according to the subnet mask.

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation). The term "subnet" is short for "sub-network".

A subnet mask has 32 bits. If a bit in the subnet mask is a "1" then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is "0" then the corresponding bit in the IP address is part of the host ID.

The following example shows a subnet mask identifying the network number (in bold text) and host ID of an IP address (192.168.1.2 in decimal).

Table 153 Subnet Masks

	1ST OCTET: (192)	2ND OCTET: (168)	3RD OCTET: (1)	4TH OCTET (2)
IP Address (Binary)	11000000	10101000	00000001	00000010
Subnet Mask (Binary)	**11111111**	**11111111**	**11111111**	00000000
Network Number	**11000000**	**10101000**	**00000001**	
Host ID				00000010

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Subnet masks can be referred to by the size of the network number part (the bits with a "1" value). For example, an "8-bit mask" means that the first 8 bits of the mask are ones and the remaining 24 bits are zeroes.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The following examples show the binary and decimal notation for 8-bit, 16-bit, 24-bit and 29-bit subnet masks.

Table 154 Subnet Masks

	BINARY				DECIMAL
	1ST OCTET	2ND OCTET	3RD OCTET	4TH OCTET	
8-bit mask	11111111	00000000	00000000	00000000	255.0.0.0
16-bit mask	11111111	11111111	00000000	00000000	255.255.0.0
24-bit mask	11111111	11111111	11111111	00000000	255.255.255.0
29-bit mask	11111111	11111111	11111111	11111000	255.255.255.248

Network Size

The size of the network number determines the maximum number of possible hosts you can have on your network. The larger the number of network number bits, the smaller the number of remaining host ID bits.

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 with a 24-bit subnet mask, for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 with a 24-bit subnet mask, for example).

As these two IP addresses cannot be used for individual hosts, calculate the maximum number of possible hosts in a network as follows:

Table 155 Maximum Host Numbers

SUBNET MASK		HOST ID SIZE		MAXIMUM NUMBER OF HOSTS
8 bits	255.0.0.0	24 bits	$2^{24} - 2$	16777214
16 bits	255.255.0.0	16 bits	$2^{16} - 2$	65534
24 bits	255.255.255.0	8 bits	$2^{8} - 2$	254
29 bits	255.255.255.248	3 bits	$2^{3} - 2$	6

Notation

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with subnet mask 255.255.255.128.

The following table shows some possible subnet masks using both notations.

Table 156 Alternative Subnet Mask Notation

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128

Table 156 Alternative Subnet Mask Notation (continued)

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.192	/26	1100 0000	192
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

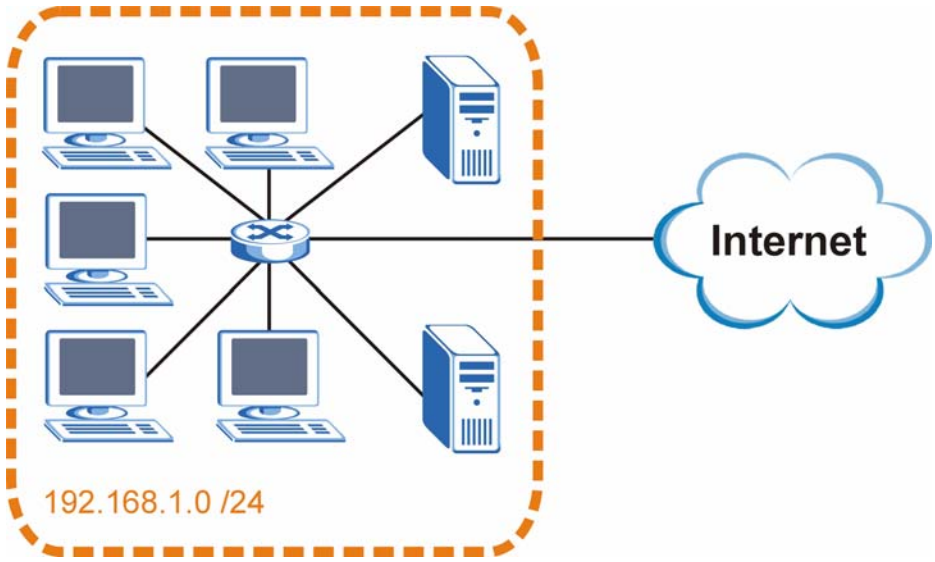
Subnetting

You can use subnetting to divide one network into multiple sub-networks. In the following example a network administrator creates two sub-networks to isolate a group of servers from the rest of the company network for security reasons.

In this example, the company network address is 192.168.1.0. The first three octets of the address (192.168.1) are the network number, and the remaining octet is the host ID, allowing a maximum of $2^8 - 2$ or 254 possible hosts.

The following figure shows the company network before subnetting.

Figure 224 Subnetting Example: Before Subnetting

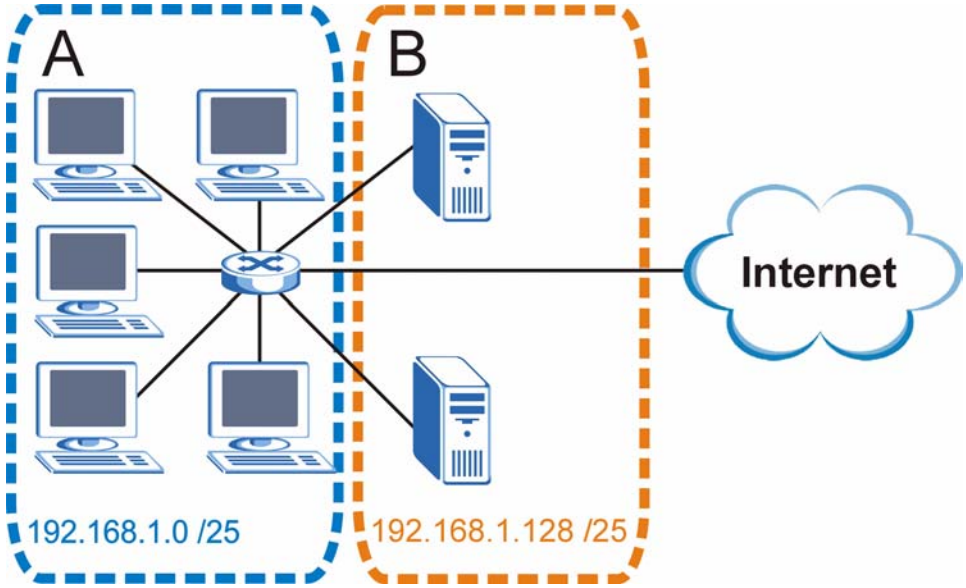


You can "borrow" one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

The "borrowed" host ID bit can have a value of either 0 or 1, allowing two subnets; 192.168.1.0 /25 and 192.168.1.128 /25.

The following figure shows the company network after subnetting. There are now two sub-networks, **A** and **B**.

Figure 225 Subnetting Example: After Subnetting



In a 25-bit subnet the host ID has 7 bits, so each sub-network has a maximum of $2^7 - 2$ or 126 possible hosts (a host ID of all zeroes is the subnet's address itself, all ones is the subnet's broadcast address).

192.168.1.0 with mask 255.255.255.128 is subnet **A** itself, and 192.168.1.127 with mask 255.255.255.128 is its broadcast address. Therefore, the lowest IP address that can be assigned to an actual host for subnet **A** is 192.168.1.1 and the highest is 192.168.1.126.

Similarly, the host ID range for subnet **B** is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The previous example illustrated using a 25-bit subnet mask to divide a 24-bit address into two subnets. Similarly, to divide a 24-bit address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192.

Each subnet contains 6 host ID bits, giving 2^6 - 2 or 62 hosts for each subnet (a host ID of all zeroes is the subnet itself, all ones is the subnet's broadcast address).

Table 157 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 158 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 159 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 160 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example: Eight Subnets

Similarly, use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows IP address last octet values for each subnet.

Table 161 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127

Table 161 Eight Subnets (continued)

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

Subnet Planning

The following table is a summary for subnet planning on a network with a 24-bit network number.

Table 162 24-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

The following table is a summary for subnet planning on a network with a 16-bit network number.

Table 163 16-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14
13	255.255.255.248 (/29)	8192	6

Table 163 16-bit Network Number Subnet Planning (continued)

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the ZyXEL Device.

Once you have decided on the network number, pick an IP address for your ZyXEL Device that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your ZyXEL Device will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the ZyXEL Device unless you are instructed to do otherwise.

Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet (running only between two branch offices, for example) you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP, or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, *Address Allocation for Private Internets* and RFC 1466, *Guidelines for Management of IP Address Space.*

D

Wireless LANs

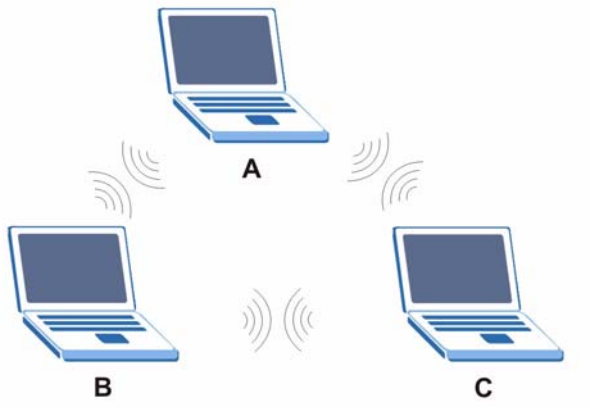
Wireless LAN Topologies

This section discusses ad-hoc and infrastructure wireless LAN topologies.

Ad-hoc Wireless LAN Configuration

The simplest WLAN configuration is an independent (Ad-hoc) WLAN that connects a set of computers with wireless stations (A, B, C). Any time two or more wireless adapters are within range of each other, they can set up an independent network, which is commonly referred to as an Ad-hoc network or Independent Basic Service Set (IBSS). The following diagram shows an example of notebook computers using wireless adapters to form an Ad-hoc wireless LAN.

Figure 226 Peer-to-Peer Communication in an Ad-hoc Network

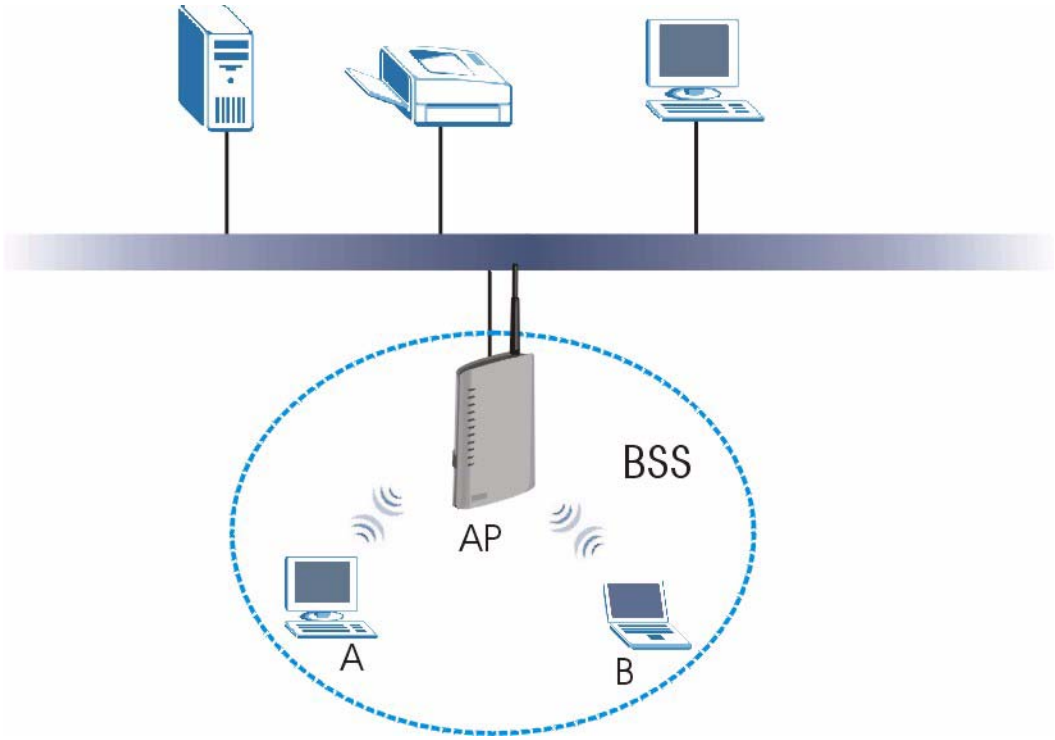


BSS

A Basic Service Set (BSS) exists when all communications between wireless stations or between a wireless station and a wired network client go through one access point (AP).

Intra-BSS traffic is traffic between wireless stations in the BSS. When Intra-BSS is enabled, wireless station A and B can access the wired network and communicate with each other. When Intra-BSS is disabled, wireless station A and B can still access the wired network but cannot communicate with each other.

Figure 227 Basic Service Set



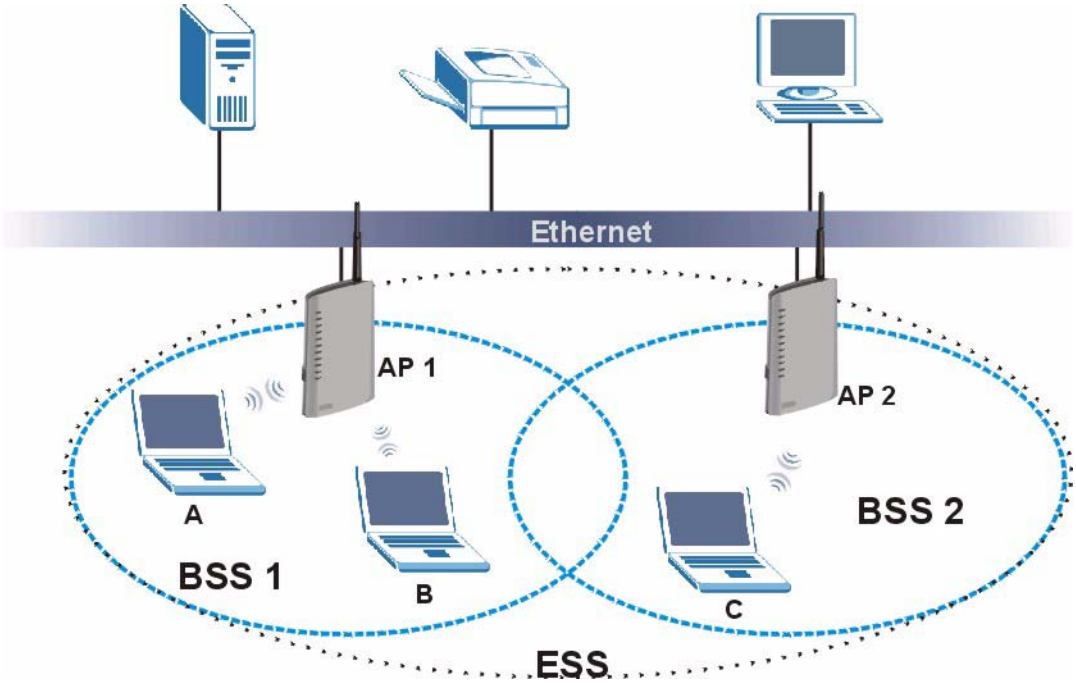
ESS

An Extended Service Set (ESS) consists of a series of overlapping BSSs, each containing an access point, with each access point connected together by a wired network. This wired connection between APs is called a Distribution System (DS).

This type of wireless LAN topology is called an Infrastructure WLAN. The Access Points not only provide communication with the wired network but also mediate wireless network traffic in the immediate neighborhood.

An ESSID (ESS IDentification) uniquely identifies each ESS. All access points and their associated wireless stations within the same ESS must have the same ESSID in order to communicate.

Figure 228 Infrastructure WLAN



Channel

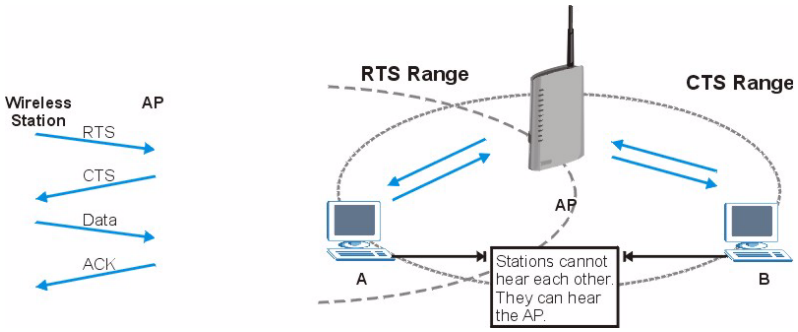
A channel is the radio frequency(ies) used by IEEE 802.11a/b/g wireless devices. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a different channel than an adjacent AP (access point) to reduce interference. Interference occurs when radio signals from different access points overlap causing interference and degrading performance.

Adjacent channels partially overlap however. To avoid interference due to overlap, your AP should be on a channel at least five channels away from a channel that an adjacent AP is using. For example, if your region has 11 channels and an adjacent AP is using channel 1, then you need to select a channel between 6 or 11.

RTS/CTS

A hidden node occurs when two stations are within range of the same access point, but are not within range of each other. The following figure illustrates a hidden node. Both stations (STA) are within range of the access point (AP) or wireless gateway, but out-of-range of each other, so they cannot "hear" each other, that is they do not know if the channel is currently being used. Therefore, they are considered hidden from each other.

Figure 229 RTS/CTS



When station A sends data to the AP, it might not know that the station B is already using the channel. If these two stations send data at the same time, collisions may occur when both sets of data arrive at the AP at the same time, resulting in a loss of messages for both stations.

RTS/CTS is designed to prevent collisions due to hidden nodes. An **RTS/CTS** defines the biggest size data frame you can send before an RTS (Request To Send)/CTS (Clear to Send) handshake is invoked.

When a data frame exceeds the **RTS/CTS** value you set (between 0 to 2432 bytes), the station that wants to transmit this frame must first send an RTS (Request To Send) message to the AP for permission to send it. The AP then responds with a CTS (Clear to Send) message to all other stations within its range to notify them to defer their transmission. It also reserves and confirms with the requesting station the time frame for the requested transmission.

Stations can send frames smaller than the specified **RTS/CTS** directly to the AP without the RTS (Request To Send)/CTS (Clear to Send) handshake.

You should only configure **RTS/CTS** if the possibility of hidden nodes exists on your network and the "cost" of resending large frames is more than the extra network overhead involved in the RTS (Request To Send)/CTS (Clear to Send) handshake.

If the **RTS/CTS** value is greater than the **Fragmentation Threshold** value (see next), then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Enabling the RTS Threshold causes redundant network overhead that could negatively affect the throughput performance instead of providing a remedy.

Fragmentation Threshold

A **Fragmentation Threshold** is the maximum data fragment size (between 256 and 2432 bytes) that can be sent in the wireless network before the AP will fragment the packet into smaller data frames.

A large **Fragmentation Threshold** is recommended for networks not prone to interference while you should set a smaller threshold for busy networks or networks that are prone to interference.

If the **Fragmentation Threshold** value is smaller than the **RTS/CTS** value (see previously) you set then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Preamble Type

A preamble is used to synchronize the transmission timing in your wireless network. There are two preamble modes: **Long** and **Short**.

Short preamble takes less time to process and minimizes overhead, so it should be used in a good wireless network environment when all wireless stations support it.

Select **Long** if you have a 'noisy' network or are unsure of what preamble mode your wireless stations support as all IEEE 802.11b compliant wireless adapters must support long preamble. However, not all wireless adapters support short preamble. Use long preamble if you are unsure what preamble mode the wireless adapters support, to ensure interpretability between the AP and the wireless stations and to provide more reliable communication in 'noisy' networks.

Select **Dynamic** to have the AP automatically use short preamble when all wireless stations support it, otherwise the AP uses long preamble.

The AP and the wireless stations MUST use the same preamble mode in order to communicate.

IEEE 802.11g Wireless LAN

IEEE 802.11g is fully compatible with the IEEE 802.11b standard. This means an IEEE 802.11b adapter can interface directly with an IEEE 802.11g access point (and vice versa) at 11 Mbps or lower depending on range. IEEE 802.11g has several intermediate rate steps between the maximum and minimum data rates. The IEEE 802.11g data rate and modulation are as follows:

Table 164 IEEE 802.11g

DATA RATE (MBPS)	MODULATION
1	DBPSK (Differential Binary Phase Shift Keyed)
2	DQPSK (Differential Quadrature Phase Shift Keying)
5.5 / 11	CCK (Complementary Code Keying)
6/9/12/18/24/36/48/54	OFDM (Orthogonal Frequency Division Multiplexing)

IEEE 802.1x

In June 2001, the IEEE 802.1x standard was designed to extend the features of IEEE 802.11 to support extended authentication as well as providing additional accounting and control features. It is supported by Windows XP and a number of network devices. Some advantages of IEEE 802.1x are:

- User based identification that allows for roaming.
- Support for RADIUS (Remote Authentication Dial In User Service, RFC 2138, 2139) for centralized user profile and accounting management on a network RADIUS server.
- Support for EAP (Extensible Authentication Protocol, RFC 2486) that allows additional authentication methods to be deployed with no changes to the access point or the wireless stations.

RADIUS

RADIUS is based on a client-server model that supports authentication, authorization and accounting. The access point is the client and the server is the RADIUS server. The RADIUS server handles the following tasks:

- Authentication
  Determines the identity of the users.
- Authorization
  Determines the network services available to authenticated users once they are connected to the network.
- Accounting
  Keeps track of the client's network activity.

RADIUS is a simple package exchange in which your AP acts as a message relay between the wireless station and the network RADIUS server.

Types of RADIUS Messages

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user authentication:

- Access-Request
  Sent by an access point requesting authentication.
- Access-Reject
  Sent by a RADIUS server rejecting access.
- Access-Accept
  Sent by a RADIUS server allowing access.
- Access-Challenge
  Sent by a RADIUS server requesting more information in order to allow access. The access point sends a proper response from the user and then sends another Access-Request message.

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user accounting:

- Accounting-Request
  Sent by the access point requesting accounting.
- Accounting-Response
  Sent by the RADIUS server to indicate that it has started or stopped accounting.

In order to ensure network security, the access point and the RADIUS server use a shared secret key, which is a password, they both know. The key is not sent over the network. In addition to the shared key, password information exchanged is also encrypted to protect the network from unauthorized access.

Types of Authentication

This appendix discusses some popular authentication types: **EAP-MD5**, **EAP-TLS**, **EAP-TTLS**, **PEAP** and **LEAP**.

The type of authentication you use depends on the RADIUS server or the AP. Consult your network administrator for more information.

EAP-MD5 (Message-Digest Algorithm 5)

MD5 authentication is the simplest one-way authentication method. The authentication server sends a challenge to the wireless station. The wireless station 'proves' that it knows the password by encrypting the password with the challenge and sends back the information. Password is not sent in plain text.

However, MD5 authentication has some weaknesses. Since the authentication server needs to get the plaintext passwords, the passwords must be stored. Thus someone other than the authentication server may access the password file. In addition, it is possible to impersonate an authentication server as MD5 authentication method does not perform mutual authentication. Finally, MD5 authentication method does not support data encryption with dynamic session key. You must configure WEP encryption keys for data encryption.

EAP-TLS (Transport Layer Security)

With EAP-TLS, digital certifications are needed by both the server and the wireless stations for mutual authentication. The server presents a certificate to the client. After validating the identity of the server, the client sends a different certificate to the server. The exchange of certificates is done in the open before a secured tunnel is created. This makes user identity vulnerable to passive attacks. A digital certificate is an electronic ID card that authenticates the sender's identity. However, to implement EAP-TLS, you need a Certificate Authority (CA) to handle certificates, which imposes a management overhead.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection. Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

PEAP (Protected EAP)

Like EAP-TTLS, server-side certificate authentication is used to establish a secure connection, then use simple username and password methods through the secured connection to authenticate the clients, thus hiding client identity. However, PEAP only supports EAP methods, such as EAP-MD5, EAP-MSCHAPv2 and EAP-GTC (EAP-Generic Token Card), for client authentication. EAP-GTC is implemented only by Cisco.

LEAP

LEAP (Lightweight Extensible Authentication Protocol) is a Cisco implementation of IEEE 802.1x.

Dynamic WEP Key Exchange

The AP maps a unique key that is generated with the RADIUS server. This key expires when the wireless connection times out, disconnects or reauthentication times out. A new WEP key is generated each time reauthentication is performed.

If this feature is enabled, it is not necessary to configure a default encryption key in the Wireless screen. You may still configure and store keys here, but they will not be used while Dynamic WEP is enabled.

EAP-MD5 cannot be used with Dynamic WEP Key Exchange

For added security, certificate-based authentications (EAP-TLS, EAP-TTLS and PEAP) use dynamic keys for data encryption. They are often deployed in corporate environments, but for public deployment, a simple user name and password pair is more practical. The following table is a comparison of the features of authentication types.

Table 165 Comparison of EAP Authentication Types

	EAP-MD5	EAP-TLS	EAP-TTLS	PEAP	LEAP
Mutual Authentication	No	Yes	Yes	Yes	Yes
Certificate – Client	No	Yes	Optional	Optional	No
Certificate – Server	No	Yes	Yes	Yes	No
Dynamic Key Exchange	No	Yes	Yes	Yes	Yes
Credential Integrity	None	Strong	Strong	Strong	Moderate
Deployment Difficulty	Easy	Hard	Moderate	Moderate	Moderate
Client Identity Protection	No	No	Yes	Yes	No

WPA

User Authentication

WPA applies IEEE 802.1x and Extensible Authentication Protocol (EAP) to authenticate wireless stations using an external RADIUS database.

Encryption

WPA improves data encryption by using Temporal Key Integrity Protocol (TKIP) or Advanced Encryption Standard (AES), Message Integrity Check (MIC) and IEEE 802.1x.

TKIP uses 128-bit keys that are dynamically generated and distributed by the authentication server. It includes a per-packet key mixing function, a Message Integrity Check (MIC) named Michael, an extended initialization vector (IV) with sequencing rules, and a re-keying mechanism.

TKIP regularly changes and rotates the encryption keys so that the same encryption key is never used twice.

The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless stations. This all happens in the background automatically.

AES (Advanced Encryption Standard) also uses a secret key. This implementation of AES applies a 128-bit key to 128-bit blocks of data.

The Message Integrity Check (MIC) is designed to prevent an attacker from capturing data packets, altering them and resending them. The MIC provides a strong mathematical function in which the receiver and the transmitter each compute and then compare the MIC. If they do not match, it is assumed that the data has been tampered with and the packet is dropped.

By generating unique data encryption keys for every data packet and by creating an integrity checking mechanism (MIC), TKIP makes it much more difficult to decrypt data on a Wi-Fi network than WEP, making it difficult for an intruder to break into the network.

The encryption mechanisms used for WPA and WPA-PSK are the same. The only difference between the two is that WPA-PSK uses a simple common password, instead of user-specific credentials. The common-password approach makes WPA-PSK susceptible to brute-force password-guessing attacks but it's still an improvement over WEP as it employs an easier-to-use, consistent, single, alphanumeric password.

Security Parameters Summary

Refer to this table to see what other security parameters you should configure for each Authentication Method/ key management protocol type. MAC address filters are not dependent on how you configure these security features.

Table 166 Wireless Security Relational Matrix

AUTHENTICATION METHOD/ KEY MANAGEMENT PROTOCOL	ENCRYPTION METHOD	ENTER MANUAL KEY	ENABLE IEEE 802.1X
Open	None	No	No
Open	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable

Table 166 Wireless Security Relational Matrix (continued)

AUTHENTICATION METHOD/ KEY MANAGEMENT PROTOCOL	ENCRYPTION METHOD	ENTER MANUAL KEY	ENABLE IEEE 802.1X
Shared	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
WPA	WEP	No	Yes
WPA	TKIP	No	Yes
WPA-PSK	WEP	Yes	Yes
WPA-PSK	TKIP	Yes	Yes

E

Services

The following table lists some commonly-used services and their associated protocols and port numbers.

- **Name**: This is a short, descriptive name for the service. You can use this one or create a different one, if you like.
- **Protocol**: This is the type of IP protocol used by the service. If this is **TCP/UDP**, then the service uses the same port number with TCP and UDP. If this is **USER-DEFINED**, the **Port(s)** is the IP protocol number, not the port number.
- **Port(s)**: This value depends on the **Protocol**.
  - If the **Protocol** is **TCP**, **UDP**, or **TCP/UDP**, this is the IP port number.
  - If the **Protocol** is **USER**, this is the IP protocol number.
- **Description**: This is a brief explanation of the applications that use this service or the situations in which this service is used.

Table 167 Examples of Services

NAME	PROTOCOL	PORT(S)	DESCRIPTION
AH (IPSEC_TUNNEL)	User-Defined	51	The IPSEC AH (Authentication Header) tunneling protocol uses this service.
AIM	TCP	5190	AOL's Internet Messenger service.
AUTH	TCP	113	Authentication protocol used by some servers.
BGP	TCP	179	Border Gateway Protocol.
BOOTP_CLIENT	UDP	68	DHCP Client.
BOOTP_SERVER	UDP	67	DHCP Server.
CU-SEEME	TCP/UDP TCP/UDP	7648 24032	A popular videoconferencing solution from White Pines Software.
DNS	TCP/UDP	53	Domain Name Server, a service that matches web names (for instance www.zyxel.com) to IP numbers.
ESP (IPSEC_TUNNEL)	User-Defined	50	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
FINGER	TCP	79	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.
FTP	TCP TCP	20 21	File Transfer Protocol, a program to enable fast transfer of files, including large files that may not be possible by e-mail.

Table 167 Examples of Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
H.323	TCP	1720	NetMeeting uses this protocol.
HTTP	TCP	80	Hyper Text Transfer Protocol - a client/ server protocol for the world wide web.
HTTPS	TCP	443	HTTPS is a secured http session often used in e-commerce.
ICMP	User-Defined	1	Internet Control Message Protocol is often used for diagnostic purposes.
ICQ	UDP	4000	This is a popular Internet chat program.
IGMP (MULTICAST)	User-Defined	2	Internet Group Multicast Protocol is used when sending packets to a specific group of hosts.
IKE	UDP	500	The Internet Key Exchange algorithm is used for key distribution and management.
IMAP4	TCP	143	The Internet Message Access Protocol is used for e-mail.
IMAP4S	TCP	993	This is a more secure version of IMAP4 that runs over SSL.
IRC	TCP/UDP	6667	This is another popular Internet chat program.
MSN Messenger	TCP	1863	Microsoft Networks' messenger service uses this protocol.
NetBIOS	TCP/UDP TCP/UDP TCP/UDP TCP/UDP	137 138 139 445	The Network Basic Input/Output System is used for communication between computers in a LAN.
NEW-ICQ	TCP	5190	An Internet chat program.
NEWS	TCP	144	A protocol for news groups.
NFS	UDP	2049	Network File System - NFS is a client/ server distributed file service that provides transparent file sharing for network environments.
NNTP	TCP	119	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING	User-Defined	1	Packet INternet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
POP3	TCP	110	Post Office Protocol version 3 lets a client computer get e-mail from a POP3 server through a temporary connection (TCP/IP or other).
POP3S	TCP	995	This is a more secure version of POP3 that runs over SSL.
PPTP	TCP	1723	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.

Table 167 Examples of Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
PPTP_TUNNEL (GRE)	User-Defined	47	PPTP (Point-to-Point Tunneling Protocol) enables secure transfer of data over public networks. This is the data channel.
RCMD	TCP	512	Remote Command Service.
REAL_AUDIO	TCP	7070	A streaming audio service that enables real time sound over the web.
REXEC	TCP	514	Remote Execution Daemon.
RLOGIN	TCP	513	Remote Login.
ROADRUNNER	TCP/UDP	1026	This is an ISP that provides services mainly for cable modems.
RTELNET	TCP	107	Remote Telnet.
RTSP	TCP/UDP	554	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP	TCP	115	The Simple File Transfer Protocol is an old way of transferring files between computers.
SMTP	TCP	25	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.
SMTPS	TCP	465	This is a more secure version of SMTP that runs over SSL.
SNMP	TCP/UDP	161	Simple Network Management Program.
SNMP-TRAPS	TCP/UDP	162	Traps for use with the SNMP (RFC:1215).
SQL-NET	TCP	1521	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSDP	UDP	1900	The Simple Service Discovery Protocol supports Universal Plug-and-Play (UPnP).
SSH	TCP/UDP	22	Secure Shell Remote Login Program.
STRM WORKS	UDP	1558	Stream Works Protocol.
SYSLOG	UDP	514	Syslog allows you to send system logs to a UNIX server.
TACACS	UDP	49	Login Host Protocol used for (Terminal Access Controller Access Control System).
TELNET	TCP	23	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.

Table 167 Examples of Services (continued)

NAME	PROTOCOL	PORT(S)	DESCRIPTION
TFTP	UDP	69	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
VDOLIVE	TCP UDP	7000 user-defined	A videoconferencing solution. The UDP port number is specified in the application.

F

Internal SPTGEN

Internal SPTGEN Overview

Internal SPTGEN (System Parameter Table Generator) is a configuration text file useful for efficient configuration of multiple ZyXEL Devices. Internal SPTGEN lets you configure, save and upload multiple menus at the same time using just one configuration text file – eliminating the need to navigate and configure individual screens for each ZyXEL Device.

The Configuration Text File Format

All Internal SPTGEN text files conform to the following format:

```
<field identification number = field name = parameter values allowed =
input>,
```

where <input> is your input conforming to <parameter values allowed>.

The figure shown next is an example of an Internal SPTGEN text file.

Figure 230 Configuration Text File Format: Column Descriptions

```
/ Menu 1 General Setup
 10000000 = Configured                <0(No)| 1(Yes)>       = 1
 10000001 = System Name               <Str>                 = Your Device
 10000002 = Location                  <Str>                 =
 10000003 = Contact Person's Name     <Str>                 =
 10000004 = Route IP                  <0(No)| 1(Yes)>       = 1
 10000005 = Route IPX                <0(No)| 1(Yes)>       = 0
 10000006 = Bridge                   <0(No)| 1(Yes)>       = 0
```

DO NOT alter or delete any field except parameters in the Input column.

This appendix introduces Internal SPTGEN. All menus shown in this appendix are example menus meant to show SPTGEN usage. Actual menus for your product may differ.

Internal SPTGEN File Modification - Important Points to Remember

Each parameter you enter must be preceded by one "="sign and one space.

Some parameters are dependent on others. For example, if you disable the **Configured** field in menu 1 (see Figure 230 on page 377), then you disable every field in this menu.

If you enter a parameter that is invalid in the **Input** column, the ZyXEL Device will not save the configuration and the command line will display the **Field Identification Number**. Figure 231 on page 378, shown next, is an example of what the ZyXEL Device displays if you enter a value other than "0" or "1" in the **Input** column of **Field Identification Number** 1000000 (refer to Figure 230 on page 377).

Figure 231 Invalid Parameter Entered: Command Line Example

```
field value is not legal error:-1
ROM-t is not saved, error Line ID:10000000
reboot to get the original configuration
Bootbase Version: V2.02 | 2/22/2001 13:33:11
RAM: Size = 8192 Kbytes
FLASH: Intel 8M *2
```

The ZyXEL Device will display the following if you enter parameter(s) that *are* valid.

Figure 232 Valid Parameter Entered: Command Line Example

```
Please wait for the system to write SPT text file(ROM-t)...
Bootbase Version: V2.02 | 2/22/2001 13:33:11
RAM: Size = 8192 Kbytes
FLASH: Intel 8M *2
```

Internal SPTGEN FTP Download Example

1. Launch your FTP application.
2. Enter "`bin`". The command "`bin`" sets the transfer mode to binary.
3. Get "`rom-t`" file. The command "`get`" transfers files from the ZyXEL Device to your computer. The name "`rom-t`" is the configuration filename on the ZyXEL Device.
4. Edit the "`rom-t`" file using a text editor (do not use a word processor). You must leave this FTP screen to edit.

Figure 233 Internal SPTGEN FTP Download Example

```
c:\ftp 192.168.1.1
220 PPP FTP version 1.0 ready at Sat Jan 1 03:22:12 2000
User (192.168.1.1:(none)):
331 Enter PASS command
Password:
230 Logged in
ftp>bin
200 Type I OK
ftp> get rom-t
ftp>bye
c:\edit rom-t
(edit the rom-t text file by a text editor and save it)
```

You can rename your "rom-t" file when you save it to your computer but it must be named "rom-t" when you upload it to your ZyXEL Device.

Internal SPTGEN FTP Upload Example

1. Launch your FTP application.
2. Enter "bin". The command "bin" sets the transfer mode to binary.
3. Upload your "rom-t" file from your computer to the ZyXEL Device using the "put" command. computer to the ZyXEL Device.
4. Exit this FTP application.

Figure 234 Internal SPTGEN FTP Upload Example

```
c:\ftp 192.168.1.1
220 PPP FTP version 1.0 ready at Sat Jan 1 03:22:12 2000
User (192.168.1.1:(none)):
331 Enter PASS command
Password:
230 Logged in
ftp>bin
200 Type I OK
ftp> put rom-t
ftp>bye
```

Example Internal SPTGEN Screens

This section covers ZyXEL Device Internal SPTGEN screens.

Table 168 Abbreviations Used in the Example Internal SPTGEN Screens Table

ABBREVIATION	MEANING
FIN	Field Identification Number
FN	Field Name

Table 168 Abbreviations Used in the Example Internal SPTGEN Screens Table

ABBREVIATION	MEANING
PVA	Parameter Values Allowed
INPUT	An example of what you may enter
*	Applies to the ZyXEL Device.

The following are the Internal SPTGEN menus.

Table 169 Menu 1 General Setup

/ Menu 1 General Setup			
FIN	FN	PVA	INPUT
10000000 =	Configured	<0(No) | 1(Yes)>	= 0
10000001 =	System Name	<Str>	= Your Device
10000002 =	Location	<Str>	=
10000003 =	Contact Person's Name	<Str>	=
10000004 =	Route IP	<0(No) | 1(Yes)>	= 1
10000006 =	Bridge	<0(No) | 1(Yes)>	= 0

Table 170 Menu 3

/ Menu 3.1 General Ethernet Setup			
FIN	FN	PVA	INPUT
30100001 =	Input Protocol filters Set 1		= 2
30100002 =	Input Protocol filters Set 2		= 256
30100003 =	Input Protocol filters Set 3		= 256
30100004 =	Input Protocol filters Set 4		= 256
30100005 =	Input device filters Set 1		= 256
30100006 =	Input device filters Set 2		= 256
30100007 =	Input device filters Set 3		= 256
30100008 =	Input device filters Set 4		= 256
30100009 =	Output protocol filters Set 1		= 256
30100010 =	Output protocol filters Set 2		= 256
30100011 =	Output protocol filters Set 3		= 256
30100012 =	Output protocol filters Set 4		= 256
30100013 =	Output device filters Set 1		= 256
30100014 =	Output device filters Set 2		= 256
30100015 =	Output device filters Set 3		= 256
30100016 =	Output device filters Set 4		= 256
/ Menu 3.2 TCP/IP and DHCP Ethernet Setup			
FIN	FN	PVA	INPUT
30200001 =	DHCP	<0(None) | 1(Server) | 2(Relay)>	= 0

Table 170 Menu 3

30200002 =	Client IP Pool Starting Address		= 192.168.1.33
30200003 =	Size of Client IP Pool		= 32
30200004 =	Primary DNS Server		= 0.0.0.0
30200005 =	Secondary DNS Server		= 0.0.0.0
30200006 =	Remote DHCP Server		= 0.0.0.0
30200008 =	IP Address		= 172.21.2.200
30200009 =	IP Subnet Mask		= 16
30200010 =	RIP Direction	<0(None) | 1(Both) | 2(In Only) | 3(Out Only)>	= 0
30200011 =	Version	<0(Rip-1) | 1(Rip-2B) |2(Rip-2M)>	= 0
30200012 =	Multicast	<0(IGMP-v2) | 1(IGMP-v1) | 2(None)>	= 2
30200013 =	IP Policies Set 1 (1~12)		= 256
30200014 =	IP Policies Set 2 (1~12)		= 256
30200015 =	IP Policies Set 3 (1~12)		= 256
30200016 =	IP Policies Set 4 (1~12)		= 256
/ Menu 3.2.1 IP Alias Setup			
FIN	FN	PVA	INPUT
30201001 =	IP Alias 1	<0(No) | 1(Yes)>	= 0
30201002 =	IP Address		= 0.0.0.0
30201003 =	IP Subnet Mask		= 0
30201004 =	RIP Direction	<0(None) | 1(Both) | 2(In Only) | 3(Out Only)>	= 0
30201005 =	Version	<0(Rip-1) | 1(Rip-2B) |2(Rip-2M)>	= 0
30201006 =	IP Alias #1 Incoming protocol filters Set 1		= 256
30201007 =	IP Alias #1 Incoming protocol filters Set 2		= 256
30201008 =	IP Alias #1 Incoming protocol filters Set 3		= 256
30201009 =	IP Alias #1 Incoming protocol filters Set 4		= 256
30201010 =	IP Alias #1 Outgoing protocol filters Set 1		= 256

Table 170 Menu 3

30201011 =	IP Alias #1 Outgoing protocol filters Set 2		= 256
30201012 =	IP Alias #1 Outgoing protocol filters Set 3		= 256
30201013 =	IP Alias #1 Outgoing protocol filters Set 4		= 256
30201014 =	IP Alias 2 <0(No) | 1(Yes)>		= 0
30201015 =	IP Address		= 0.0.0.0
30201016 =	IP Subnet Mask		= 0
30201017 =	RIP Direction	<0(None) | 1(Both) | 2(In Only) | 3(Out Only)>	= 0
30201018 =	Version	<0(Rip-1) | 1(Rip-2B) |2(Rip-2M)>	= 0
30201019 =	IP Alias #2 Incoming protocol filters Set 1		= 256
30201020 =	IP Alias #2 Incoming protocol filters Set 2		= 256
30201021 =	IP Alias #2 Incoming protocol filters Set 3		= 256
30201022 =	IP Alias #2 Incoming protocol filters Set 4		= 256
30201023 =	IP Alias #2 Outgoing protocol filters Set 1		= 256
30201024 =	IP Alias #2 Outgoing protocol filters Set 2		= 256
30201025 =	IP Alias #2 Outgoing protocol filters Set 3		= 256
30201026 =	IP Alias #2 Outgoing protocol filters Set 4		= 256
*/ Menu 3.5 Wireless LAN Setup			
FIN	FN	PVA	INPUT
30500001 =	ESSID		Wireless
30500002 =	Hide ESSID	<0(No) | 1(Yes)>	= 0
30500003 =	Channel ID	<1|2|3|4|5|6|7|8|9|10|11|12|13>	= 1
30500004 =	RTS Threshold	<0 ~ 2432>	= 2432
30500005 =	FRAG. Threshold	<256 ~ 2432>	= 2432
30500006 =	WEP	<0(DISABLE) | 1(64-bit WEP) | 2(128-bit WEP)>	= 0

Table 170 Menu 3

30500007 =	Default Key	<1|2|3|4>	= 0
30500008 =	WEP Key1		=
30500009 =	WEP Key2		=
30500010 =	WEP Key3		=
30500011 =	WEP Key4		=
30500012 =	Wlan Active	<0(Disable) | 1(Enable)>	= 0
*/ MENU 3.5.1 WLAN MAC ADDRESS FILTER			
FIN	FN	PVA	INPUT
30501001 =	Mac Filter Active	<0(No) | 1(Yes)>	= 0
30501002 =	Filter Action	<0(Allow) | 1(Deny)>	= 0
30501003 =	Address 1		= 00:00:00:00:00:00
30501004 =	Address 2		= 00:00:00:00:00:00
30501005 =	Address 3		= 00:00:00:00:00:00
Continued	…		…
30501034 =	Address 32		= 00:00:00:00:00:00

Table 171 Menu 4 Internet Access Setup

/ Menu 4 Internet Access Setup			
FIN	FN	PVA	INPUT
40000000 =	Configured	<0(No) | 1(Yes)>	= 1
40000001 =	ISP	<0(No) | 1(Yes)>	= 1
40000002 =	Active	<0(No) | 1(Yes)>	= 1
40000003 =	ISP's Name		= ChangeMe
40000004 =	Encapsulation	<2(PPPOE) | 3(RFC 1483)| 4(PPPoA)| 5(ENET ENCAP)>	= 2
40000005 =	Multiplexing	<1(LLC-based) | 2(VC-based)	= 1

Table 171 Menu 4 Internet Access Setup (continued)

40000006 =	VPI #		= 0
40000007 =	VCI #		= 35
40000008 =	Service Name	<Str>	= any
40000009 =	My Login	<Str>	= test@pqa
40000010 =	My Password	<Str>	= 1234
40000011 =	Single User Account	<0(No) | 1(Yes)>	= 1
40000012 =	IP Address Assignment	<0(Static)|1(Dynamic)>	= 1
40000013 =	IP Address		= 0.0.0.0
40000014 =	Remote IP address		= 0.0.0.0
40000015 =	Remote IP subnet mask		= 0
40000016 =	ISP incoming protocol filter set 1		= 6
40000017 =	ISP incoming protocol filter set 2		= 256
40000018 =	ISP incoming protocol filter set 3		= 256
40000019 =	ISP incoming protocol filter set 4		= 256
40000020 =	ISP outgoing protocol filter set 1		= 256
40000021 =	ISP outgoing protocol filter set 2		= 256
40000022 =	ISP outgoing protocol filter set 3		= 256
40000023 =	ISP outgoing protocol filter set 4		= 256
40000024 =	ISP PPPoE idle timeout		= 0
40000025 =	Route IP	<0(No) | 1(Yes)>	= 1
40000026 =	Bridge	<0(No) | 1(Yes)>	= 0
40000027 =	ATM QoS Type	<0(CBR) | (1 (UBR)>	= 1
40000028 =	Peak Cell Rate (PCR)		= 0
40000029 =	Sustain Cell Rate (SCR)		= 0
40000030 =	Maximum Burst Size(MBS)		= 0
40000031=	RIP Direction	<0(None) | 1(Both) | 2(In Only) | 3(Out Only)>	= 0
40000032=	RIP Version	<0(Rip-1) | 1(Rip-2B) |2(Rip-2M)>	= 0
40000033=	Nailed-up Connection	<0(No) |1(Yes)>	= 0

Table 172 Menu 12

/ Menu 12.1.1 IP Static Route Setup			
FIN	FN	PVA	INPUT
120101001 =	IP Static Route set #1, Name	<Str>	=
120101002 =	IP Static Route set #1, Active	<0(No) |1(Yes)>	= 0
120101003 =	IP Static Route set #1, Destination IP address		= 0.0.0.0
120101004 =	IP Static Route set #1, Destination IP subnetmask		= 0
120101005 =	IP Static Route set #1, Gateway		= 0.0.0.0
120101006 =	IP Static Route set #1, Metric		= 0
120101007 =	IP Static Route set #1, Private	<0(No) |1(Yes)>	= 0
/ Menu 12.1.2 IP Static Route Setup			
FIN	FN	PVA	INPUT
120102001 =	IP Static Route set #2, Name		=
120102002 =	IP Static Route set #2, Active	<0(No) |1(Yes)>	= 0
120102003 =	IP Static Route set #2, Destination IP address		= 0.0.0.0
120102004 =	IP Static Route set #2, Destination IP subnetmask		= 0
120102005 =	IP Static Route set #2, Gateway		= 0.0.0.0
120102006 =	IP Static Route set #2, Metric		= 0
120102007 =	IP Static Route set #2, Private	<0(No) |1(Yes)>	= 0
/ Menu 12.1.3 IP Static Route Setup			
FIN	FN	PVA	INPUT
120103001 =	IP Static Route set #3, Name	<Str>	=
120103002 =	IP Static Route set #3, Active	<0(No) |1(Yes)>	= 0
120103003 =	IP Static Route set #3, Destination IP address		= 0.0.0.0
120103004 =	IP Static Route set #3, Destination IP subnetmask		= 0
120103005 =	IP Static Route set #3, Gateway		= 0.0.0.0
120103006 =	IP Static Route set #3, Metric		= 0
120103007 =	IP Static Route set #3, Private	<0(No) |1(Yes)>	= 0
/ Menu 12.1.4 IP Static Route Setup			
FIN	FN	PVA	INPUT
120104001 =	IP Static Route set #4, Name	<Str>	=
120104002 =	IP Static Route set #4, Active	<0(No) |1(Yes)>	= 0
120104003 =	IP Static Route set #4, Destination IP address		= 0.0.0.0
120104004 =	IP Static Route set #4, Destination IP subnetmask		= 0

Table 172 Menu 12 (continued)

120104005 =	IP Static Route set #4, Gateway		= 0.0.0.0
120104006 =	IP Static Route set #4, Metric		= 0
120104007 =	IP Static Route set #4, Private	<0(No) |1(Yes)>	= 0
/ Menu 12.1.5 IP Static Route Setup			
FIN	FN	PVA	INPUT
120105001 =	IP Static Route set #5, Name	<Str>	=
120105002 =	IP Static Route set #5, Active	<0(No) |1(Yes)>	= 0
120105003 =	IP Static Route set #5, Destination IP address		= 0.0.0.0
120105004 =	IP Static Route set #5, Destination IP subnetmask		= 0
120105005 =	IP Static Route set #5, Gateway		= 0.0.0.0
120105006 =	IP Static Route set #5, Metric		= 0
120105007 =	IP Static Route set #5, Private	<0(No) |1(Yes)>	= 0
/ Menu 12.1.6 IP Static Route Setup			
FIN	FN	PVA	INPUT
120106001 =	IP Static Route set #6, Name	<Str>	=
120106002 =	IP Static Route set #6, Active	<0(No) |1(Yes)>	= 0
120106003 =	IP Static Route set #6, Destination IP address		= 0.0.0.0
120106004 =	IP Static Route set #6, Destination IP subnetmask		= 0
120106005 =	IP Static Route set #6, Gateway		= 0.0.0.0
120106006 =	IP Static Route set #6, Metric		= 0
120106007 =	IP Static Route set #6, Private	<0(No) |1(Yes)>	= 0
/ Menu 12.1.7 IP Static Route Setup			
FIN	FN	PVA	INPUT
120107001 =	IP Static Route set #7, Name	<Str>	=
120107002 =	IP Static Route set #7, Active	<0(No) |1(Yes)>	= 0
120107003 =	IP Static Route set #7, Destination IP address		= 0.0.0.0
120107004 =	IP Static Route set #7, Destination IP subnetmask		= 0
120107005 =	IP Static Route set #7, Gateway		= 0.0.0.0
120107006 =	IP Static Route set #7, Metric		= 0
120107007 =	IP Static Route set #7, Private	<0(No) |1(Yes)>	= 0
/ Menu 12.1.8 IP Static Route Setup			
FIN	FN	PVA	INPUT
120108001 =	IP Static Route set #8, Name	<Str>	=
120108002 =	IP Static Route set #8, Active	<0(No) |1(Yes)>	= 0
120108003 =	IP Static Route set #8, Destination IP address		= 0.0.0.0

Table 172 Menu 12 (continued)

120108004 =	IP Static Route set #8, Destination IP subnetmask		= 0
120108005 =	IP Static Route set #8, Gateway		= 0.0.0.0
120108006 =	IP Static Route set #8, Metric		= 0
120108007 =	IP Static Route set #8, Private	<0(No) |1(Yes)>	= 0
*/ Menu 12.1.9 IP Static Route Setup			
FIN	FN	PVA	INPUT
120109001 =	IP Static Route set #9, Name	<Str>	=
120109002 =	IP Static Route set #9, Active	<0(No) |1(Yes)>	= 0
120109003 =	IP Static Route set #9, Destination IP address		= 0.0.0.0
120109004 =	IP Static Route set #9, Destination IP subnetmask		= 0
120109005 =	IP Static Route set #9, Gateway		= 0.0.0.0
120109006 =	IP Static Route set #9, Metric		= 0
120109007 =	IP Static Route set #9, Private	<0(No) |1(Yes)>	= 0
*/ Menu 12.1.10 IP Static Route Setup			
FIN	FN	PVA	INPUT
120110001 =	IP Static Route set #10, Name		=
120110002 =	IP Static Route set #10, Active	<0(No) |1(Yes)>	= 0
120110003 =	IP Static Route set #10, Destination IP address		= 0.0.0.0
120110004 =	IP Static Route set #10, Destination IP subnetmask		= 0
120110005 =	IP Static Route set #10, Gateway		= 0.0.0.0
120110006 =	IP Static Route set #10, Metric		= 0
120110007 =	IP Static Route set #10, Private	<0(No) |1(Yes)>	= 0
*/ Menu 12.1.11 IP Static Route Setup			
FIN	FN	PVA	INPUT
120111001 =	IP Static Route set #11, Name	<Str>	=
120111002 =	IP Static Route set #11, Active	<0(No) |1(Yes)>	= 0
120111003 =	IP Static Route set #11, Destination IP address		= 0.0.0.0
120111004 =	IP Static Route set #11, Destination IP subnetmask		= 0
120111005 =	IP Static Route set #11, Gateway		= 0.0.0.0
120111006 =	IP Static Route set #11, Metric		= 0
120111007 =	IP Static Route set #11, Private	<0(No) |1(Yes)>	= 0
*/ Menu 12.1.12 IP Static Route Setup			
FIN	FN	PVA	INPUT
120112001 =	IP Static Route set #12, Name	<Str>	=
120112002 =	IP Static Route set #12, Active	<0(No) |1(Yes)>	= 0

Table 172 Menu 12 (continued)

120112003 =	IP Static Route set #12, Destination IP address		= 0.0.0.0
120112004 =	IP Static Route set #12, Destination IP subnetmask		= 0
120112005 =	IP Static Route set #12, Gateway		= 0.0.0.0
120112006 =	IP Static Route set #12, Metric		= 0
120112007 =	IP Static Route set #12, Private	<0(No) |1(Yes)>	= 0
*/ Menu 12.1.13 IP Static Route Setup			
FIN	FN	PVA	INPUT
120113001 =	IP Static Route set #13, Name	<Str>	=
120113002 =	IP Static Route set #13, Active	<0(No) |1(Yes)>	= 0
120113003 =	IP Static Route set #13, Destination IP address		= 0.0.0.0
120113004 =	IP Static Route set #13, Destination IP subnetmask		= 0
120113005 =	IP Static Route set #13, Gateway		= 0.0.0.0
120113006 =	IP Static Route set #13, Metric		= 0
120113007 =	IP Static Route set #13, Private	<0(No) |1(Yes)>	= 0
*/ Menu 12.1.14 IP Static Route Setup			
FIN	FN	PVA	INPUT
120114001 =	IP Static Route set #14, Name	<Str>	=
120114002 =	IP Static Route set #14, Active	<0(No) |1(Yes)>	= 0
120114003 =	IP Static Route set #14, Destination IP address		= 0.0.0.0
120114004 =	IP Static Route set #14, Destination IP subnetmask		= 0
120114005 =	IP Static Route set #14, Gateway		= 0.0.0.0
120114006 =	IP Static Route set #14, Metric		= 0
120114007 =	IP Static Route set #14, Private	<0(No) |1(Yes)>	= 0
*/ Menu 12.1.15 IP Static Route Setup			
FIN	FN	PVA	INPUT
120115001 =	IP Static Route set #15, Name	<Str>	=
120115002 =	IP Static Route set #15, Active	<0(No) |1(Yes)>	= 0
120115003 =	IP Static Route set #15, Destination IP address		= 0.0.0.0
120115004 =	IP Static Route set #15, Destination IP subnetmask		= 0
120115005 =	IP Static Route set #15, Gateway		= 0.0.0.0
120115006 =	IP Static Route set #15, Metric		= 0
120115007 =	IP Static Route set #15, Private	<0(No) |1(Yes)>	= 0
*/ Menu 12.1.16 IP Static Route Setup			
FIN	FN	PVA	INPUT

Table 172 Menu 12 (continued)

120116001 =	IP Static Route set #16, Name	<Str>	=
120116002 =	IP Static Route set #16, Active	<0(No) |1(Yes)>	= 0
120116003 =	IP Static Route set #16, Destination IP address		= 0.0.0.0
120116004 =	IP Static Route set #16, Destination IP subnetmask		= 0
120116005 =	IP Static Route set #16, Gateway		= 0.0.0.0
120116006 =	IP Static Route set #16, Metric		= 0
120116007 =	IP Static Route set #16, Private	<0(No) |1(Yes)>	= 0

Table 173 Menu 15 SUA Server Setup

/ Menu 15 SUA Server Setup			
FIN	FN	PVA	INPUT
150000001 =	SUA Server IP address for default port		= 0.0.0.0
150000002 =	SUA Server #2 Active	<0(No) | 1(Yes)>	= 0
150000003 =	SUA Server #2 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000004 =	SUA Server #2 Port Start		= 0
150000005 =	SUA Server #2 Port End		= 0
150000006 =	SUA Server #2 Local IP address		= 0.0.0.0
150000007 =	SUA Server #3 Active	<0(No) | 1(Yes)>	= 0
150000008 =	SUA Server #3 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000009 =	SUA Server #3 Port Start		= 0
150000010 =	SUA Server #3 Port End		= 0
150000011 =	SUA Server #3 Local IP address		= 0.0.0.0
150000012 =	SUA Server #4 Active	<0(No) | 1(Yes)>	= 0
150000013 =	SUA Server #4 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000014 =	SUA Server #4 Port Start		= 0
150000015 =	SUA Server #4 Port End		= 0
150000016 =	SUA Server #4 Local IP address		= 0.0.0.0
150000017 =	SUA Server #5 Active	<0(No) | 1(Yes)>	= 0
150000018 =	SUA Server #5 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000019 =	SUA Server #5 Port Start		= 0
150000020 =	SUA Server #5 Port End		= 0
150000021 =	SUA Server #5 Local IP address		= 0.0.0.0
150000022 =	SUA Server #6 Active	<0(No) | 1(Yes)> = 0	= 0

Table 173 Menu 15 SUA Server Setup (continued)

150000023 =	SUA Server #6 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000024 =	SUA Server #6 Port Start		= 0
150000025 =	SUA Server #6 Port End		= 0
150000026 =	SUA Server #6 Local IP address		= 0.0.0.0
150000027 =	SUA Server #7 Active	<0(No) | 1(Yes)>	= 0
150000028 =	SUA Server #7 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0.0.0.0
150000029 =	SUA Server #7 Port Start		= 0
150000030 =	SUA Server #7 Port End		= 0
150000031 =	SUA Server #7 Local IP address		= 0.0.0.0
150000032 =	SUA Server #8 Active	<0(No) | 1(Yes)>	= 0
150000033 =	SUA Server #8 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000034 =	SUA Server #8 Port Start		= 0
150000035 =	SUA Server #8 Port End		= 0
150000036 =	SUA Server #8 Local IP address		= 0.0.0.0
150000037 =	SUA Server #9 Active	<0(No) | 1(Yes)>	= 0
150000038 =	SUA Server #9 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000039 =	SUA Server #9 Port Start		= 0
150000040 =	SUA Server #9 Port End		= 0
150000041 =	SUA Server #9 Local IP address		= 0.0.0.0
150000042	= SUA Server #10 Active	<0(No) | 1(Yes)>	= 0
150000043 =	SUA Server #10 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000044 =	SUA Server #10 Port Start		= 0
150000045 =	SUA Server #10 Port End		= 0
150000046 =	SUA Server #10 Local IP address		= 0.0.0.0
150000047 =	SUA Server #11 Active	<0(No) | 1(Yes)>	= 0
150000048 =	SUA Server #11 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000049 =	SUA Server #11 Port Start		= 0
150000050 =	SUA Server #11 Port End		= 0
150000051 =	SUA Server #11 Local IP address		= 0.0.0.0
150000052 =	SUA Server #12 Active	<0(No) | 1(Yes)>	= 0
150000053 =	SUA Server #12 Protocol	<0(All)|6(TCP)|17(UDP)>	= 0
150000054 =	SUA Server #12 Port Start		= 0
150000055 =	SUA Server #12 Port End		= 0
150000056 =	SUA Server #12 Local IP address		= 0.0.0.0

Table 174 Menu 21.1 Filter Set #1

/ Menu 21 Filter set #1			
FIN	FN	PVA	INPUT
210100001 =	Filter Set 1, Name	<Str>	=
/ Menu 21.1.1.1 set #1, rule #1			
FIN	FN	PVA	INPUT
210101001 =	IP Filter Set 1,Rule 1 Type	<2(TCP/IP)>	= 2
210101002 =	IP Filter Set 1,Rule 1 Active	<0(No)|1(Yes)>	= 1
210101003 =	IP Filter Set 1,Rule 1 Protocol		= 6
210101004 =	IP Filter Set 1,Rule 1 Dest IP address		= 0.0.0.0
210101005 =	IP Filter Set 1,Rule 1 Dest Subnet Mask		= 0
210101006 =	IP Filter Set 1,Rule 1 Dest Port		= 137
210101007 =	IP Filter Set 1,Rule 1 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210101008 =	IP Filter Set 1,Rule 1 Src IP address		= 0.0.0.0
210101009 =	IP Filter Set 1,Rule 1 Src Subnet Mask		= 0
210101010 =	IP Filter Set 1,Rule 1 Src Port		= 0
210101011 =	IP Filter Set 1,Rule 1 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210101013 =	IP Filter Set 1,Rule 1 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210101014 =	IP Filter Set 1,Rule 1 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1
/ Menu 21.1.1.2 set #1, rule #2			
FIN	FN	PVA	INPUT
210102001 =	IP Filter Set 1,Rule 2 Type	<2(TCP/IP)>	= 2
210102002 =	IP Filter Set 1,Rule 2 Active	<0(No)|1(Yes)>	= 1
210102003 =	IP Filter Set 1,Rule 2 Protocol		= 6
210102004 =	IP Filter Set 1,Rule 2 Dest IP address		= 0.0.0.0
210102005 =	IP Filter Set 1,Rule 2 Dest Subnet Mask		= 0
210102006 =	IP Filter Set 1,Rule 2 Dest Port		= 138
210102007 =	IP Filter Set 1,Rule 2 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210102008 =	IP Filter Set 1,Rule 2 Src IP address		= 0.0.0.0

Table 174 Menu 21.1 Filter Set #1 (continued)

210102009 =	IP Filter Set 1,Rule 2 Src Subnet Mask		= 0
210102010 =	IP Filter Set 1,Rule 2 Src Port		= 0
210102011 =	IP Filter Set 1,Rule 2 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210102013 =	IP Filter Set 1,Rule 2 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210102014 =	IP Filter Set 1,Rule 2 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1
/ Menu 21.1.1.3 set #1, rule #3			
FIN	FN	PVA	INPUT
210103001 =	IP Filter Set 1,Rule 3 Type	<2(TCP/IP)>	= 2
210103002 =	IP Filter Set 1,Rule 3 Active	<0(No)|1(Yes)>	= 1
210103003 =	IP Filter Set 1,Rule 3 Protocol		= 6
210103004 =	IP Filter Set 1,Rule 3 Dest IP address		= 0.0.0.0
210103005 =	IP Filter Set 1,Rule 3 Dest Subnet Mask		= 0
210103006 =	IP Filter Set 1,Rule 3 Dest Port		= 139
210103007 =	IP Filter Set 1,Rule 3 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210103008 =	IP Filter Set 1,Rule 3 Src IP address		= 0.0.0.0
210103009 =	IP Filter Set 1,Rule 3 Src Subnet Mask		= 0
210103010 =	IP Filter Set 1,Rule 3 Src Port		= 0
210103011 =	IP Filter Set 1,Rule 3 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210103013 =	IP Filter Set 1,Rule 3 Act Match	<1(check next)|2(forward)|3(drop)	= 3
210103014 =	IP Filter Set 1,Rule 3 Act Not Match	<1(check next)|2(forward)|3(drop)	= 1
/ Menu 21.1.1.4 set #1, rule #4			
FIN	FN	PVA	INPUT
210104001 =	IP Filter Set 1,Rule 4 Type	<2(TCP/IP)>	= 2
210104002 =	IP Filter Set 1,Rule 4 Active	<0(No)|1(Yes)>	= 1
210104003 =	IP Filter Set 1,Rule 4 Protocol		= 17
210104004 =	IP Filter Set 1,Rule 4 Dest IP address		= 0.0.0.0

Table 174 Menu 21.1 Filter Set #1 (continued)

210104005 =	IP Filter Set 1,Rule 4 Dest Subnet Mask		= 0
210104006 =	IP Filter Set 1,Rule 4 Dest Port		= 137
210104007 =	IP Filter Set 1,Rule 4 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210104008 =	IP Filter Set 1,Rule 4 Src IP address		= 0.0.0.0
210104009 =	IP Filter Set 1,Rule 4 Src Subnet Mask		= 0
210104010 =	IP Filter Set 1,Rule 4 Src Port		= 0
210104011 =	IP Filter Set 1,Rule 4 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210104013 =	IP Filter Set 1,Rule 4 Act Match	<1(check next)|2(forward) | 3(drop)	= 3
210104014 =	IP Filter Set 1,Rule 4 Act Not Match	<1(check next)|2(forward)|3(drop)	= 1
/ Menu 21.1.1.5 set #1, rule #5			
FIN	FN	PVA	INPUT
210105001 =	IP Filter Set 1,Rule 5 Type	<2(TCP/IP)>	= 2
210105002 =	IP Filter Set 1,Rule 5 Active	<0(No)|1(Yes)>	= 1
210105003 =	IP Filter Set 1,Rule 5 Protocol		= 17
210105004 =	IP Filter Set 1,Rule 5 Dest IP address		= 0.0.0.0
210105005 =	IP Filter Set 1,Rule 5 Dest Subnet Mask		= 0
210105006 =	IP Filter Set 1,Rule 5 Dest Port		= 138
210105007 =	IP Filter Set 1,Rule 5 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210105008 =	IP Filter Set 1,Rule 5 Src IP Address		= 0.0.0.0
210105009 =	IP Filter Set 1,Rule 5 Src Subnet Mask		= 0
210105010 =	IP Filter Set 1,Rule 5 Src Port		= 0
210105011 =	IP Filter Set 1,Rule 5 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210105013 =	IP Filter Set 1,Rule 5 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210105014 =	IP Filter Set 1,Rule 5 Act Not Match	<1(Check Next)|2(Forward)|3(Drop)>	= 1

Table 174 Menu 21.1 Filter Set #1 (continued)

/ Menu 21.1.1.6 set #1, rule #6			
FIN	FN	PVA	INPUT
210106001 =	IP Filter Set 1,Rule 6 Type	<2(TCP/IP)>	= 2
210106002 =	IP Filter Set 1,Rule 6 Active	<0(No)|1(Yes)>	= 1
210106003 =	IP Filter Set 1,Rule 6 Protocol		= 17
210106004 =	IP Filter Set 1,Rule 6 Dest IP address		= 0.0.0.0
210106005 =	IP Filter Set 1,Rule 6 Dest Subnet Mask		= 0
210106006 =	IP Filter Set 1,Rule 6 Dest Port		= 139
210106007 =	IP Filter Set 1,Rule 6 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210106008 =	IP Filter Set 1,Rule 6 Src IP address		= 0.0.0.0
210106009 =	IP Filter Set 1,Rule 6 Src Subnet Mask		= 0
210106010 =	IP Filter Set 1,Rule 6 Src Port		= 0
210106011 =	IP Filter Set 1,Rule 6 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210106013 =	IP Filter Set 1,Rule 6 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210106014 =	IP Filter Set 1,Rule 6 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 2

Table 175 Menu 21.1 Filer Set #2,

/ Menu 21.1 filter set #2,			
FIN	FN	PVA	INPUT
210200001 =	Filter Set 2, Nam	<Str>	= NetBIOS_WAN
/ Menu 21.1.2.1 Filter set #2, rule #1			
FIN	FN	PVA	INPUT
210201001 =	IP Filter Set 2, Rule 1 Type	<0(none)|2(TCP/IP)>	= 2
210201002 =	IP Filter Set 2, Rule 1 Active	<0(No)|1(Yes)>	= 1
210201003 =	IP Filter Set 2, Rule 1 Protocol		= 6
210201004 =	IP Filter Set 2, Rule 1 Dest IP address		= 0.0.0.0
210201005 =	IP Filter Set 2, Rule 1 Dest Subnet Mask		= 0
210201006 =	IP Filter Set 2, Rule 1 Dest Port		= 137

Table 175 Menu 21.1 Filer Set #2, (continued)

210201007 =	IP Filter Set 2, Rule 1 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210201008 =	IP Filter Set 2, Rule 1 Src IP address		= 0.0.0.0
210201009 =	IP Filter Set 2, Rule 1 Src Subnet Mask		= 0
210201010 =	IP Filter Set 2, Rule 1 Src Port		= 0
210201011 =	IP Filter Set 2, Rule 1 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210201013 =	IP Filter Set 2, Rule 1 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210201014 =	IP Filter Set 2, Rule 1 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1
/ Menu 21.1.2.2 Filter set #2, rule #2			
FIN	FN	PVA	INPUT
210202001 =	IP Filter Set 2, Rule 2 Type	<0(none)|2(TCP/IP)>	= 2
210202002 =	IP Filter Set 2, Rule 2 Active	<0(No)|1(Yes)>	= 1
210202003 =	IP Filter Set 2, Rule 2 Protocol		= 6
210202004 =	IP Filter Set 2, Rule 2 Dest IP address		= 0.0.0.0
210202005 =	IP Filter Set 2, Rule 2 Dest Subnet Mask		= 0
210202006 =	IP Filter Set 2, Rule 2 Dest Port		= 138
210202007 =	IP Filter Set 2, Rule 2 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210202008 =	IP Filter Set 2, Rule 2 Src IP address		= 0.0.0.0
210202009 =	IP Filter Set 2, Rule 2 Src Subnet Mask		= 0
210202010 =	IP Filter Set 2,Rule 2 Src Port		= 0
210202011 =	IP Filter Set 2, Rule 2 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210202013 =	IP Filter Set 2, Rule 2 Act Match	<1(check next)|2(forward)|3(drop)>	= 3

Table 175 Menu 21.1 Filer Set #2, (continued)

210202014 =	IP Filter Set 2, Rule 2 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1
/ Menu 21.1.2.3 Filter set #2, rule #3			
FIN	FN	PVA	INPUT
210203001 =	IP Filter Set 2, Rule 3 Type	<0(none)|2(TCP/IP)>	= 2
210203002 =	IP Filter Set 2, Rule 3 Active	<0(No)|1(Yes)>	= 1
210203003 =	IP Filter Set 2, Rule 3 Protocol		= 6
210203004 =	IP Filter Set 2, Rule 3 Dest IP address		= 0.0.0.0
210203005 =	IP Filter Set 2, Rule 3 Dest Subnet Mask		= 0
210203006 =	IP Filter Set 2, Rule 3 Dest Port		= 139
210203007 =	IP Filter Set 2, Rule 3 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210203008 =	IP Filter Set 2, Rule 3 Src IP address		= 0.0.0.0
210203009 =	IP Filter Set 2,Rule 3 Src Subnet Mask		= 0
210203010 =	IP Filter Set 2, Rule 3 Src Port		= 0
210203011 =	IP Filter Set 2, Rule 3 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210203013 =	IP Filter Set 2, Rule 3 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210203014 =	IP Filter Set 2,Rule 3 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1
/ Menu 21.1.2.4 Filter set #2, rule #4			
FIN	FN	PVA	INPUT
210204001 =	IP Filter Set 2, Rule 4 Type	<0(none)|2(TCP/IP)>	= 2
210204002 =	IP Filter Set 2, Rule 4 Active		<0(No)|1(Yes)> = 1
210204003 =	IP Filter Set 2, Rule 4 Protocol		= 17
210204004 =	IP Filter Set 2, Rule 4 Dest IP address		= 0.0.0.0
210204005 =	IP Filter Set 2, Rule 4 Dest Subnet Mask		= 0
210204006 =	IP Filter Set 2, Rule 4 Dest Port		= 137

Table 175 Menu 21.1 Filer Set #2, (continued)

210204007 =	IP Filter Set 2, Rule 4 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210204008 =	IP Filter Set 2, Rule 4 Src IP address		= 0.0.0.0
210204009 =	IP Filter Set 2, Rule 4 Src Subnet Mask		= 0
210204010 =	IP Filter Set 2, Rule 4 Src Port		= 0
210204011 =	IP Filter Set 2, Rule 4 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210204013 =	IP Filter Set 2, Rule 4 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210204014 =	IP Filter Set 2, Rule 4 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1
/ Menu 21.1.2.5 Filter set #2, rule #5			
FIN	FN	PVA	INPUT
210205001 =	IP Filter Set 2, Rule 5 Type	<0(none)|2(TCP/IP)>	= 2
210205002 =	IP Filter Set 2, Rule 5 Active	<0(No)|1(Yes)>	= 1
210205003 =	IP Filter Set 2,Rule 5 Protocol		= 17
210205004 =	IP Filter Set 2, Rule 5 Dest IP address		= 0.0.0.0
210205005 =	IP Filter Set 2, Rule 5 Dest Subnet Mask		= 0
210205006 =	IP Filter Set 2, Rule 5 Dest Port		= 138
210205007 =	IP Filter Set 2, Rule 5 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210205008 =	IP Filter Set 2, Rule 5 Src IP address		= 0.0.0.0
210205009 =	IP Filter Set 2, Rule 5 Src Subnet Mask		= 0
210205010 =	IP Filter Set 2, Rule 5 Src Port		= 0
210205011 =	IP Filter Set 2, Rule 5 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210205013 =	IP Filter Set 2, Rule 5 Act Match	<1(check next)|2(forward)|3(drop)>	= 3

Table 175 Menu 21.1 Filer Set #2, (continued)

210205014 =	IP Filter Set 2, Rule 5 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 1
/ Menu 21.1.2.6 Filter set #2, rule #6			
FIN	FN	PVA	INPUT
210206001 =	IP Filter Set 2, Rule 6 Type	<0(none)|2(TCP/IP)>	= 2
210206002 =	IP Filter Set 2, Rule 6 Active	<0(No)|1(Yes)>	= 1
210206003 =	IP Filter Set 2, Rule 6 Protocol		= 17
210206004 =	IP Filter Set 2, Rule 6 Dest IP address		= 0.0.0.0
210206005 =	IP Filter Set 2, Rule 6 Dest Subnet Mask		= 0
210206006 =	IP Filter Set 2, Rule 6 Dest Port		= 139
210206007 =	IP Filter Set 2, Rule 6 Dest Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 1
210206008 =	IP Filter Set 2, Rule 6 Src IP address		= 0.0.0.0
210206009 =	IP Filter Set 2, Rule 6 Src Subnet Mask		= 0
210206010 =	IP Filter Set 2, Rule 6 Src Port		= 0
210206011 =	IP Filter Set 2, Rule 6 Src Port Comp	<0(none)|1(equal)|2(not equal)|3(less)|4(greater)>	= 0
210206013 =	IP Filter Set 2,Rule 6 Act Match	<1(check next)|2(forward)|3(drop)>	= 3
210206014 =	IP Filter Set 2,Rule 6 Act Not Match	<1(check next)|2(forward)|3(drop)>	= 2
241100005 =	FTP Server Access	<0(all)|1(none)|2(Lan)|3(Wan)>	= 0
241100006 =	FTP Server Secured IP address		= 0.0.0.0
241100007 =	WEB Server Port		= 80
241100008 =	WEB Server Access	<0(all)|1(none)|2(Lan) |3(Wan)>	= 0
241100009 =	WEB Server Secured IP address		= 0.0.0.0

Table 176 Menu 23 System Menus

*/ Menu 23.1 System Password Setup			
FIN	FN	PVA	INPUT

Table 176 Menu 23 System Menus (continued)

230000000 =	System Password		= 1234
*/ Menu 23.2 System security: radius server			
FIN	FN	PVA	INPUT
230200001 =	Authentication Server Configured	<0(No) | 1(Yes)>	= 1
230200002 =	Authentication Server Active	<0(No) | 1(Yes)>	= 1
230200003 =	Authentication Server IP Address		= 192.168.1.32
230200004 =	Authentication Server Port		= 1822
230200005 =	Authentication Server Shared Secret		= 111111111111111 111111111111111
230200006 =	Accounting Server Configured	<0(No) | 1(Yes)>	= 1
230200007 =	Accounting Server Active	<0(No) | 1(Yes)>	= 1
230200008 =	Accounting Server IP Address		= 192.168.1.44
230200009 =	Accounting Server Port		= 1823
230200010 =	Accounting Server Shared Secret		= 1234
*/ Menu 23.4 System security: IEEE802.1x			
FIN	FN	PVA	INPUT
230400001 =	Wireless Port Control	<0(Authentication Required) |1(No Access Allowed) |2(No Authentication Required)>	= 2
230400002 =	ReAuthentication Timer (in second)		= 555
230400003 =	Idle Timeout (in second)		= 999
230400004 =	Authentication Databases	<0(Local User Database Only) |1(RADIUS Only) |2(Local,RADIUS) |3(RADIUS,Local)>	= 1
230400005 =	Key Management Protocol	<0(8021x) |1(WPA) |2(WPAPSK)>	= 0
230400006 =	Dynamic WEP Key Exchange	<0(Disable) |1(64-bit WEP) |2(128-bit WEP)>	= 0
230400007 =	PSK =		=
230400008 =	WPA Mixed Mode	<0(Disable) |1(Enable)>	= 0
230400009 =	Data Privacy for Broadcast/ Multicast packets	<0(TKIP) |1(WEP)>	= 0
230400010 =	WPA Broadcast/Multicast Key Update Timer		= 0

Table 177 Menu 24.11 Remote Management Control

/ Menu 24.11 Remote Management Control			
FIN	FN	PVA	INPUT
241100001 =	TELNET Server Port		= 23
241100002 =	TELNET Server Access	<0(all)|1(none)|2(Lan)|3(Wan)>	= 0
241100003 =	TELNET Server Secured IP address		= 0.0.0.0
241100004 =	FTP Server Port		= 21
241100005 =	FTP Server Access	<0(all)|1(none)|2(Lan)|3(Wan)>	= 0
241100006 =	FTP Server Secured IP address		= 0.0.0.0
241100007 =	WEB Server Port		= 80
241100008 =	WEB Server Access	<0(all)|1(none)|2(Lan) |3(Wan)>	= 0
241100009 =	WEB Server Secured IP address		= 0.0.0.0

Command Examples

The following are example Internal SPTGEN screens associated with the ZyXEL Device's command interpreter commands.

Table 178 Command Examples

FIN	FN	PVA	INPUT
/ci command (for annex a): wan adsl opencmd			
FIN	FN	PVA	INPUT
990000001 =	ADSL OPMD	<0(glite)|1(t1.413)|2(gdmt)|3(multimode)>	= 3
/ci command (for annex B): wan adsl opencmd			
FIN	FN	PVA	INPUT
990000001 =	ADSL OPMD	<0(etsi)|1(normal)|2(gdmt)|3(multimode)>	= 3

G

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The device complies with Part 15 of FCC rules. Operation is subject to the following two conditions:

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This device has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this device does cause harmful interference to radio/television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna.
2. Increase the separation between the equipment and the receiver.
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
4. Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement

- This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- IEEE 802.11b or 802.11g operation of this product in the U.S.A. is firmware-limited to channels 1 through 11.
- To comply with FCC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.

注意 ！

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Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device has been designed for the WLAN 2.4 GHz network throughout the EC region and Switzerland, with restrictions in France.

This Class B digital apparatus complies with Canadian ICES-003.

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H

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- Brief description of the problem and the steps you took to solve it.

"+" is the (prefix) number you dial to make an international telephone call.

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